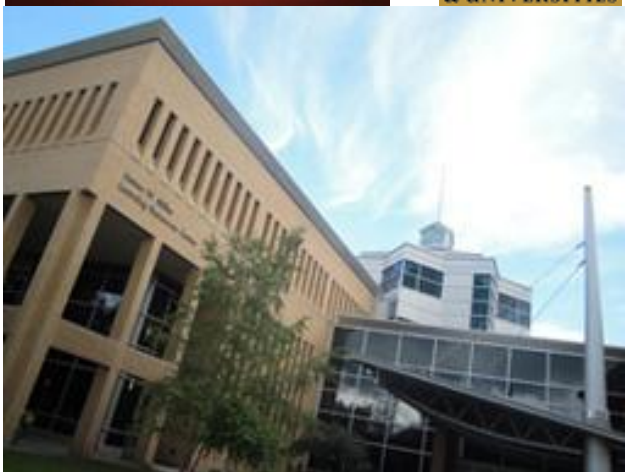
PBEEEP
State Government

# Public Buildings Enhanced Energy Efficiency Program

## Final Report
## Investigation Results For
## St Cloud State University



**Date: 5/30/2012**

Admin Minnesota
DEPARTMENT OF ADMINISTRATION

# Table of Contents





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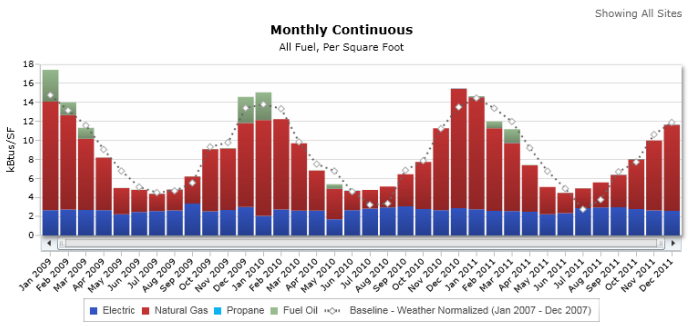
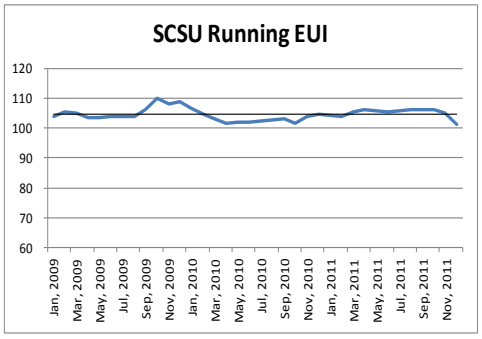
## St Cloud State University, Part 1 Energy Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of St Cloud State University, Part 1 was performed by AMEC Earth and Environmental Engineering, Inc. This report is the result of that information.

| Payback Information and Energy Savings | | | | |
|---|---|---|---|---|
| **Total project costs (Without Co-funding)** | | | **Project costs with Co-funding** | |
| Total costs to date including study | $235,432 | | Total Project Cost | $632,943 |
| Future costs including Implementation , Measurement & Verification | $397,511 | | Study and Administrative Cost Paid with ARRA Funds | ($244,432) |
| Total Project Cost | $632,943 | | Utility Co-funding | ($97,125) |
| | | | Total costs after co-funding | $291,386 |
| Estimated Annual Total Savings ($) | $78,510 | | Estimated Annual Total Savings ($) | $78,510 |
| Total Project Payback | 8.1 | | Total Project Payback with co-funding | 3.7 |
| **Electric Energy Savings ( of 30,561,785 kWh (2011)) (prorated as 28% of entire campus** | **1.9% 6.8%)** | **and** | **Natural Gas Savings ( of 2,214,669 Therms (2011)) (prorated as 28% of entire campus)** | **2.9 % 10.3 %** |




| Year | Days | SF | Total kBtu | Normalized Baseline kBtu | Change from Baseline kBtu | % Change | Total Energy Cost $ | Average Cost Rate $ /kBtu |
|---|---|---|---|---|---|---|---|---|
| 2009 | 365 | 3,292,243 | 359,021,038 | 354,449,296 | 4,571,741 | 1% | $3,892,384.07 | $0.01 |
| 2010 | 365 | 3,292,243 | 344,782,347 | 335,634,654 | 9,147,693 | 3% | $3,745,266.13 | $0.01 |
| 2011 | 365 | 3,290,909* | 333,801,426 | 342,823,967 | -9,022,541 | -3% | $3,756,243.99 | $0.01 |

*Listed square footage represents an average for the given year

St Cloud State University, Part 1 Consumption Report
Total energy use decreased about 3% during the period of the investigation

## Summary Tables

| St Cloud State University, Site Information | |
|---|---|
| Location | 740 4th Avenue South<br>St. Cloud, MN 56301 |
| Facility Manager | Tim Norton,<br>Buildings and Grounds Director |
| Buildings | 56 |
| Interior Square Footage | 3,136,612 total site<br>881,579 this project (23.3% of total building area) |
| PBEEEP Provider, Part 1 Investigation | AMEC Earth and Environmental, Inc. |
| Annual Energy Cost | $3,756,244 (from B3 2011) |
| Utility Company | Xcel Energy (natural gas and electricity)<br>Tex-Par Oil and First Fuel Banks (fuel oil)<br>Ferrellgas (propane) |
| Site Energy Use Index (EUI) | 105 kBtu/sqft (at start of project)<br>102 kBtu/sqft (end of project) |
| Benchmark EUI (from B3) | 124 kBtu/sqft |

| Building Name | State ID | Building Type | Area ($ft^2$) | Year Built |
|---|---|---|---|---|
| Central Chilled Water Plant | E26073S9999 | Mechanical | 7,590 | 1999 |
| Garvey Commons | E26073S5562 | Cafeteria | 50,984 | 1962 |
| Halenbeck Hall North | E26073S1665 | Gymnasium | 132,274 | 1965 |
| Halenbeck Hall South | E26073S1660 | Gymnasium | 100,000 | 1980 |
| Heating & Maintenance I | E26073S1050 | Mechanical | 18,892 | 1950 |
| James W. Miller LRC | E26073S9600 | Library | 235,000 | 2000 |
| Mitchell Hall | E26073S5258 | Dormitory | 109,784 | 1958 |
| National Hockey Center | E26073S2889 | Hockey Rink | 152,055 | 1989 |
| Recreation Facility | E26073S10104 | Recreation Facility | 40,000 | 2005 |
| Stadium Building | E26073S10204 | Stadium | 35,000 | 2004 |

| Mechanical Equipment Summary Table (of buildings included in the investigation) | |
|---|---|
| 1 | Tracer Summit Building Automation System by Trane |
| 10 | Buildings |
| 881,579 | Interior Square Feet |
| 62 | Air Handlers |
| 3 | Rooftop Units |
| 259 | VAV Boxes |
| 39 | Exhaust Fans and Power Roof Ventilators |
| 16 | Unit Heaters |
| 1 | Make-up Air Units |
| 2 | Chillers |
| 2 | Cooling Towers |
| 3 | Steam Boilers (dual fuel- natural gas or fuel oil) |
| 1 | Hot Water Boilers (natural gas) |
| 20 | Pumps (HW, CHW, etc) |
| 4 | Heat Exchangers |
| 750 | Approximate number of points trended |

| Implementation Information | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($) | | | $78,510 |
| Total Estimated Implementation Cost ($) | | | $397,511 |
| GHG Avoided in U.S Tons (CO2e) | | | 855 |
| Electric Energy Savings (kWh)<br>2011 Electric Usage 30,561,785 kWh (from B3) | 1.9 % Savings | | 582,344 |
| Electric Demand Savings (Peak kW)<br>7,000 kW across three feed points in 2011(B3) | 1.4 % Savings | | 105 |
| Natural Gas Savings (Therms)<br>2011 Natural Gas Usage 2,217,313Therms from B3 | 2.9 % Savings | | 64,247 |
| **Statistics** | | | |
| Number of Measures identified | | | 31 |
| Number of Measures with payback < 3 years | | | 10 |
| Screening Start Date | 3/23/2010 | Screening End Date | 10/12/2010 |
| Investigation Start Date | 2/2/2011 | Investigation End Date | 3/27/2012 |
| Final Report | 5/30/2012 | | |

| Pro Rated Savings Information (28.1% of campus area) | | |
|---|---|---|
| Estimated Annual Total Savings ($) | | $78,510 |
| Total Estimated Implementation Cost ($) | | $397,511 |
| Electric Energy Savings (kWh)<br>28% of 2011 Electric Usage 8,589,723 kWh | 6.8 % Savings | 582,344 |
| Electric Demand Savings (Peak kW)<br>28% of 2011 Peak Demand 2,000 kW | 5 % Savings | 105 |
| Natural Gas Savings (Therms)<br>Savings<br>28% of 2011 Natural Gas Usage 623,065 Therms | 10.3 % | 64,247 |

| St Cloud State University, Part 1 Cost Information | | | |
|---|---|---|---|
| **Phase** | | **To date** | **Estimated** |
| Screening | | $20,945 | |
| Investigation [Provider] | | $140,947 | |
| BAS Upgrades | | $52,207 | |
| Investigation [CEE] | | $21,333 | $1,000 |
| Implementation | | | $388,511 |
| Implementation [CEE] | | | $4,000 |
| Measurement & Verification | | 0 | $4,000 |
| Total | | $235,432 | $397,511 |

| Co-funding Summary | |
|---|---|
| Study and Administrative Cost | $244,432 |
| Utility Co-Funding - Estimated Total ($) | $97,125 |
| Total Co-funding ($) | $341,557 |

**Facility Overview**

The energy investigation identified 9.0% of prorated total energy savings at the buildings included in the St. Cloud State University, Part 1Investigation (based on the fact that these were 28% of the total floor area at St. Cloud State University) with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at St. Cloud State University are based on adjusting the schedule of equipment to match actual building occupancy hours, improving the efficiency of the building lighting, recapturing heat lost through the boiler stack. The total cost of implementing all the measures is $397,511.

Implementing all these measures can save the facility approximately $78,510 a year with a combined payback period of 4.9 years before rebates based on the implementation cost only (excluding study and administrative costs). After rebates the site will have a cost of $291,386, which reduces the payback to 3.7 years. These measures will produce 6.8% electrical savings and 10.3 % natural gas savings. These buildings are currently performing at 17% below the Minnesota Benchmarking and Beyond database (B3) benchmark value.

The primary energy intensive systems at St Cloud State University, Part 1 are described here:

***Mechanical Equipment***

The Heating Plant is located on the southern end of campus and has three steam boilers that serve the entire campus. The boilers supply 115 psi steam year-round. The steam from the Heating Plant is routed to the buildings in underground tunnels and runs through heat exchangers located in each building. The heat exchangers transfer heat from the steam to water that is pumped to the air handlers, fin tube radiation

and/or reheats in each building. All of the recommended buildings use steam from the heating plant except for the Central Chilled Water Plant, which is heated by unit heaters and the National Hockey Center which has its own hot water boiler. The Central Chilled Water Plant is located adjacent to the Heating Plant and has two chillers and two cooling towers. There are two primary pumps and two secondary pumps that send water to, and circulate water throughout, the buildings. Some of the buildings located further from the Central Chilled Water Plant have chilled water pumps that distribute chilled water throughout those buildings. All of the recommended buildings use chilled water from the Central Chilled Water Plant except for Halenbeck Hall North and South and Mitchell Hall. Halenbeck Hall North and South are not cooled except for the pool area which has direct expansion (DX) cooling with a condensing unit. Mitchell Hall also contains DX cooling with a condensing unit.

***Controls and Trending***

All ten buildings being recommended for investigation are controlled, to some extent, by a Tracer Summit Building Automation System (BAS) by Trane. There were five buildings (Central Chilled Water Plant, Halenbeck Hall North and South, James W. Miller LRC, and the Stadium and Recreation Facility) among the Phase 1 group that had Building Control Unit (BCU) panels that were outdated and were replaced as part of this project. The $52,207 cost of this upgrade was paid for as part of the project.

***Lighting***

A lighting retrofit was conducted in 1996 throughout the campus, so the majority of indoor lighting is T8 32 watt lamps. The majority of indoor lighting is controlled by occupancy sensors and the outdoor lighting is controlled by the BAS, which operates the lighting based on schedules and photocells.

***Energy Use Index B3 Benchmark***

The site Energy Use Index (EUI) of the entire campus is 106 kBtu/sqft, which is 17% lower than the B3 Benchmark of 124 kBtu/sqft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks. Because the site is not sub-metered, the performance of individual buildings is not quantified at this time.

***Metering***

The campus has a total of twenty-eight natural gas meters, twenty-six electrical meters, three fuel oil meters, and one propane meter that are currently active. There are three main electric service entries for the campus which all serve a single campus loop; the service entries allow Xcel energy to balance loads served by three substations. The other electric meters generally serve smaller detached buildings. Similarly there are gas meters that serve kitchen and laboratory areas in addition to the main gas meter. None of the buildings are individually metered.

# Findings Summary

## Site: St Cloud SU

| Eco # | Building | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|---|
| 6 | James W. Miller LRC | Over scheduling. AHU-2 | $397 | $3,304 | 0.12 | $0 | 0.12 | 52 |
| 1 | Halenbeck Hall South | Over scheduling. | $73 | $381 | 0.19 | $0 | 0.19 | 5 |
| 3 | James W. Miller LRC | Over scheduling. AHU-1 | $397 | $2,124 | 0.19 | $0 | 0.19 | 41 |
| 5 | National Hockey Center | Desiccant Unit 2 Heating in Warm Weather | $1,650 | $5,029 | 0.33 | $0 | 0.33 | 50 |
| 4 | National Hockey Center | Desiccant Unit 2 Overuse in Cold Weather | $1,708 | $4,171 | 0.41 | $0 | 0.41 | 44 |
| 1 | Husky Stadium | Excessive Enabling of AHU2. | $152 | $266 | 0.57 | $0 | 0.57 | 3 |
| 1 | Garvey Commons | Over heating. | $1,934 | $2,624 | 0.74 | $0 | 0.74 | 20 |
| 8 | James W. Miller LRC | Over scheduling. AHU-3 | $132 | $145 | 0.91 | $0 | 0.91 | 3 |
| 11 | James W. Miller LRC | Over scheduling. AHU-4 | $132 | $73 | 1.82 | $0 | 1.82 | 1 |
| 4 | Heating and Maintenance | Uninsulated steam and condensate piping. | $8,918 | $3,435 | 2.60 | $0 | 2.60 | 30 |
| 2 | Mitchell Hall | Inefficient Lighting. | $3,308 | $1,101 | 3.01 | $0 | 3.01 | 14 |
| 6 | Garvey Commons | 32 Watt T8 Lighting. | $16,340 | $4,723 | 3.46 | $0 | 3.46 | 40 |
| 2 | Halenbeck Hall North | HW valves open excessively. | $460 | $116 | 3.98 | $0 | 3.98 | 1 |
| 1 | James W. Miller LRC | 32 Watt T8 Lighting. | $33,835 | $7,922 | 4.27 | $0 | 4.27 | 78 |
| 3 | Halenbeck Hall North | 32 Watt T8 Lighting. | $1,340 | $312 | 4.29 | $0 | 4.29 | 3 |
| 2 | National Hockey Center | High Bay Lobby Lighting | $16,697 | $3,541 | 4.72 | $0 | 4.72 | 41 |
| 5 | Halenbeck Hall South | 32 Watt T8 Lighting. | $904 | $185 | 4.89 | $0 | 4.89 | 2 |
| 2 | James W. Miller LRC | No Lighting Controls. | $37,571 | $7,253 | 5.18 | $0 | 5.18 | 139 |
| 5 | Heating and Maintenance | 32 Watt T8 Lighting. | $705 | $131 | 5.39 | $0 | 5.39 | 1 |
| 7 | Heating and Maintenance | 400 Watt Metal Halide fixtures. | $8,172 | $1,441 | 5.67 | $0 | 5.67 | 15 |

# Findings Summary

## Site: St Cloud SU

| Eco # | Building | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|---|
| 2 | Husky Stadium | 32 Watt T8 Lighting. | $1,615 | $284 | 5.68 | $0 | 5.68 | 3 |
| 3 | Mitchell Hall | Inefficient Lighting. | $4,006 | $700 | 5.72 | $0 | 5.72 | 7 |
| 4 | Garvey Commons | Infiltration due to deteriorated or missing damper seals (AHU-1 &2). | $1,418 | $219 | 6.46 | $0 | 6.46 | 2 |
| 1 | Heating and Maintenance | Combustion air heating. | $204,517 | $25,158 | 8.13 | $0 | 8.13 | 220 |
| 5 | Garvey Commons | Damaged steam coil (AHU-3). | $1,446 | $172 | 8.39 | $0 | 8.39 | 1 |
| 4 | Husky Stadium | 250 Watt Metal Halide fixtures. | $12,093 | $1,417 | 8.53 | $0 | 8.53 | 15 |
| 1 | National Hockey Center | Inefficient Fluorescent Lighting | $5,019 | $533 | 9.41 | $0 | 9.41 | 6 |
| 4 | Halenbeck Hall South | Infiltration due to OA damper leaking (AHU-9 & 10). | $4,235 | $444 | 9.54 | $0 | 9.54 | 4 |
| 4 | Halenbeck Hall North | 400 Watt Metal Halide fixtures. | $5,399 | $441 | 12.24 | $0 | 12.24 | 2 |
| 3 | National Hockey Center | Lighting Controls | $10,262 | $799 | 12.84 | $0 | 12.84 | 12 |
| 6 | Halenbeck Hall South | No Lighting Controls. | $3,675 | $64 | 57.39 | $0 | 57.39 | 1 |
| | | **Total for Findings with Payback 3 years or less:** | **$15,493** | **$21,552** | **0.72** | **$0** | **0.72** | **249** |
| | | **Total for all Findings:** | **$388,511** | **$78,510** | **4.95** | **$0** | **4.95** | **855** |



PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

| Finding Type Number | Finding Type | Relevant Findings (if any) | Looked for, Not Found | Not Relevant |
|---|---|---|---|---|
| a.1 (1) | Time of Day enabling is excessive | 2 | 4 | 2 |
| a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | 1 | 6 | 1 |
| a.3 (3) | Lighting is on more hours than necessary. | 2 | 5 | 1 |
| a.4 (4) | OTHER_Equipment Scheduling/Enabling | | 4 | 4 |
| b.1 (5) | Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, | 1 | 3 | 4 |
| b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design | | 5 | 3 |
| b.3 (7) | OTHER_Economizer/OA Loads | | 4 | 4 |
| c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | 4 | 4 |
| c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | 1 | 5 | 2 |
| c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | 7 | 1 |
| c.4 (11) | OTHER_Controls | 1 | 4 | 3 |
| d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | 5 | 3 |
| d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | 5 | 3 |
| d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | 5 | 3 |
| d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | 4 | 4 |
| d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | 4 | 4 |
| d.6 (17) | Other_Controls (Setpoint Changes) | | 8 | |

| | | | | |
|---|---|---|---|---|
| **e.1 (18)** | HW Supply Temperature Reset is not implemented or is sub-optimal | | 5 | 3 |
| **e.2 (19)** | CHW Supply Temperature Reset is not implemented or is sub-optimal | | 3 | 5 |
| **e.3 (20)** | Supply Air Temperature Reset is not implemented or is sub-optimal | | 6 | 2 |
| **e.4 ( )** | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | 3 | 5 |
| **e.5 (21)** | Condenser Water Temperature Reset is not implemented or is sub-optimal | | 1 | 7 |
| **e.6 (22)** | Other_Controls (Reset Schedules) | | 7 | 1 |
| **f.1 (23)** | Daylighting Control needs optimization—Spaces are Over-Lit | | 8 | |
| **f.2 (24)** | Pump Discharge Throttled | | 6 | 2 |
| **f.3 (25)** | Over-Pumping | 1 | 5 | 2 |
| **f.4 (26)** | Equipment is oversized for load. | | 6 | 2 |
| **f.5 (27)** | OTHER_Equipment Efficiency/Load Reduction | | 7 | 1 |
| **g.1 (28)** | VFD Retrofit - Fans | | 2 | 6 |
| **g.2 (29)** | VFD Retrofit - Pumps | | 4 | 4 |
| **g.3 (30)** | VFD Retrofit - Motors (process) | | | 8 |
| **g.4 (31)** | OTHER_VFD | | 5 | 3 |
| **h.1 (32)** | Retrofit - Motors | | 6 | 2 |
| **h.2 (33)** | Retrofit - Chillers | | 1 | 7 |
| **h.3 (34)** | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | 3 | 5 |

| | | | | |
|---|---|---|---|---|
| **h.4 (35)** | Retrofit - Boilers | | 1 | 7 |
| **h.5 (36)** | Retrofit - Packaged Gas fired heating | | 4 | 4 |
| **h.6 (37)** | Retrofit - Heat Pumps | | | 8 |
| **h.7 (38)** | Retrofit - Equipment (custom) | | 4 | 4 |
| **h.8 (39)** | Retrofit - Pumping distribution method | | 3 | 5 |
| **h.9 (40)** | Retrofit - Energy/Heat Recovery | 1 | 1 | 6 |
| **h.10 (41)** | Retrofit - System (custom) | 1 | 4 | 3 |
| **h.11 (42)** | Retrofit - Efficient Lighting | 7 | 1 | |
| **h.12 (43)** | Retrofit - Building Envelope | 1 | 2 | 5 |
| **h.13 (44)** | Retrofit - Alternative Energy | | 3 | 5 |
| **h.14 (45)** | OTHER_Retrofit | | 7 | 1 |
| **i.1 (46)** | Differed Maintenance from Recommended/Standard | | 7 | 1 |
| **i.2 (47)** | Impurity/Contamination | | 7 | 1 |
| **i.3 ( )** | Leaky/Stuck Damper | 2 | 5 | 1 |
| **i.4 ( )** | Leaky/Stuck Valve | | 7 | 1 |
| **i.5 (48)** | OTHER_Maintenance | 2 | 5 | 1 |
| **j.1 (49)** | OTHER | | 7 | 1 |

## Findings Glossary: Findings Examples

| | |
|---|---|
| **a.1 (1)** | **Time of Day enabling is excessive** |
| | • HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy<br>• Optimum start-stop is not implemented<br>• Controls in hand |
| **a.2 (2)** | **Equipment is enabled regardless of need, or such enabling is excessive** |
| | • Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design.<br>• Supply air temperature and pressure reset: cooling and heating |
| **a.3 (3)** | **Lighting is on more hours than necessary** |
| | • Lighting is on at night when the building is unoccupied<br>• Photocells could be used to control exterior lighting<br>• Lighting controls not calibrated/adjusted properly |
| **a.4 (4)** | **OTHER Equipment Scheduling and Enabling** |
| | • Please contact PBEEEP Project Engineer for approval |
| **b.1 (5)** | **Economizer Operation – Inadequate Free Cooling** |
| | • Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer)<br>• Economizer linkage is broken<br>• Economizer setpoints could be optimized<br>• Plywood used as the outdoor air control<br>• Damper failed in minimum or closed position |
| **b.2 (6)** | **Over-Ventilation** |
| | • Demand-based ventilation control has been disabled<br>• Outside air damper failed in an open position<br>• Minimum outside air fraction not set to design specifications or occupancy |
| **b.3 (7)** | **OTHER Economizer/Outside Air Loads** |
| | • Please contact PBEEEP Project Engineer for approval |
| **c.1 (8)** | **Simultaneous Heating and Cooling is present and excessive** |
| | • For a given zone, CHW and HW systems are unnecessarily on and running simultaneously<br>• Different setpoints are used for two systems serving a common zone |
| **c.2 (9)** | **Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement** |
| | • OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation<br>• Zone sensors need to be relocated after tenant improvements<br>• OAT sensor reads high in sunlight |
| **c.3 (10)** | **Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints** |
| | • CHW valve cycles open and closed<br>• System needs loop tuning – it is cycling between heating and cooling |
| **c.4 (11)** | **OTHER Controls** |
| | • Please contact PBEEEP Project Engineer for approval |
| **d.1 (12)** | **Daylighting controls or occupancy sensors need optimization** |
| | • Existing controls are not functioning or overridden<br>• Light sensors improperly placed or out of calibration |
| **d.2 (13)** | **Zone setpoint setup / setback are not implemented or are sub-optimal** |
| | • The cooling setpoint is 74 ºF 24 hours per day |
| **d.3 (14)** | **Fan Speed Doesn't Vary Sufficiently** |
| | • Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design.<br>• Supply air temperature and pressure reset: cooling and heating |

| | |
|---|---|
| **d.4 (15)** | **Pump Speed Doesn't Vary Sufficiently** |
| | • Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions. |
| **d.5 (16)** | **VAV Box Minimum Flow Setpoint is higher than necessary** |
| | • Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements. |
| **d.6 (17)** | **Other Controls (Setpoint Changes)** |
| | • Please contact PBEEEP Project Engineer for approval |
| **e.1 (18)** | **HW Supply Temperature Reset is not implemented or is sub-optimal** |
| | • HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases.<br>• DHW Setpoints are constant 24 hours per day |
| **e.2 (19)** | **CHW Supply Temperature Reset is not implemented or is sub-optimal** |
| | • CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature. |
| **e.3 (20)** | **Supply Air Temperature Reset is not implemented or is sub-optimal** |
| | • The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT. |
| **e.4 ( )** | **Supply Duct Static Pressure Reset is not implemented or is suboptimal** |
| | • The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT. |
| **e.5 (21)** | **Condenser Water Temperature Reset is not implemented or is sub-optimal** |
| | • CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions. |
| **e.6 (22)** | **Other Controls (Reset Schedules)** |
| | • Please contact PBEEEP Project Engineer for approval |
| **f.1 (23)** | **Lighting system needs optimization - Spaces are overlit** |
| | • Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks |
| | |
| **f.2 (24)** | **Pump Discharge Throttled** |
| | • The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling. |
| **f.3 (25)** | **Over-Pumping** |
| | • Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed. |
| **f.4 (26)** | **Equipment is oversized for load** |
| | • The equipment cycles unnecessarily<br>• The peak load is much less than the installed equipment capacity |

| | |
|---|---|
| **f.5 (27)** | **OTHER Equipment Efficiency/Load Reduction** |
| | • Please contact PBEEEP Project Engineer for approval |
| **g.1 (28)** | **VFD Retrofit Fans** |
| | • Fan serves variable flow system, but does not have a VFD.<br>• VFD is in override mode, and was found to be not modulating. |
| **g.2 (29)** | **VFD Retrofit - Pumps** |
| | • 3-way valves are used to maintain constant flow during low load periods.<br>• Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed. |
| **g.3 (30)** | **VFD Retrofit - Motors (process)** |
| | • Motor is constant speed and uses a variable pitch sheave to obtain speed control. |
| **g.4 (31)** | **OTHER VFD** |
| | • Please contact PBEEEP Project Engineer for approval |
| **h.1 (32)** | **Retrofit - Motors** |
| | • Efficiency of installed motor is much lower than efficiency of currently available motors |
| **h.2 (33)** | **Retrofit - Chillers** |
| | • Efficiency of installed chiller is much lower than efficiency of currently available chillers |
| **h.3 (34)** | **Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)** |
| | • Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners |
| **h.4 (35)** | **Retrofit - Boilers** |
| | • Efficiency of installed boiler is much lower than efficiency of currently available boilers |
| **h.5 (36)** | **Retrofit - Packaged Gas-fired heating** |
| | • Efficiency of installed heaters is much lower than efficiency of currently available heaters |
| **h.6 (37)** | **Retrofit - Heat Pumps** |
| | • Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps |
| **h.7 (38)** | **Retrofit - Equipment (custom)** |
| | • Efficiency of installed equipment is much lower than efficiency of currently available equipment |
| **h.8 (39)** | **Retrofit - Pumping distribution method** |
| | • Current pumping distribution system is inefficient, and could be optimized.<br>• Pump distribution loop can be converted from primary to primary-secondary) |
| **h.9 (40)** | **Retrofit - Energy / Heat Recovery** |
| | • Energy is not recouped from the exhaust air.<br>• Identification of equipment with higher effectiveness than the current equipment. |
| **h.10 (41)** | **Retrofit - System (custom)** |
| | • Efficiency of installed system is much lower than efficiency of another type of system |
| **h.11 (42)** | **Retrofit - Efficient lighting** |
| | • Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures. |

| | |
|---|---|
| **h.12 (43)** | **Retrofit - Building Envelope** |
| | • Insulation is missing or insufficient<br>• Window glazing is inadequate<br>• Too much air leakage into / out of the building<br>• Mechanical systems operate during unoccupied periods in extreme weather |
| **h.13 (44)** | **Retrofit - Alternative Energy** |
| | • Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design |
| **h.14 (45)** | **OTHER Retrofit** |
| | • Please contact PBEEEP Project Engineer for approval |
| **i.1 (46)** | **Differed Maintenance from Recommended/Standard** |
| | • Differed maintenance that results in sub-optimal energy performance.<br>• Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc. |
| **i.2 (47)** | **Impurity/Contamination** |
| | • Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency. |
| **i.3 ( )** | **Leaky/Stuck Damper** |
| | • The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant. |
| **i.4 ( )** | **Leaky/Stuck Valve** |
| | • The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant. |
| **i.5 (48)** | **OTHER Maintenance** |
| | • Please contact PBEEEP Project Engineer for approval |
| **j.1 (49)** | **OTHER** |
| | • Please contact PBEEEP Project Engineer for approval |

# Findings Summary

## Building: Garvey Commons
## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 1 | Over heating. | $1,934 | $2,624 | 0.74 | $0 | 0.74 | 20 |
| 6 | 32 Watt T8 Lighting. | $16,340 | $4,723 | 3.46 | $0 | 3.46 | 40 |
| 4 | Infiltration due to deteriorated or missing damper seals (AHU-1 &2). | $1,418 | $219 | 6.46 | $0 | 6.46 | 2 |
| 5 | Damaged steam coil (AHU-3). | $1,446 | $172 | 8.39 | $0 | 8.39 | 1 |
| | **Total for Findings with Payback 3 years or less:** | **$1,934** | **$2,624** | **0.74** | **$0** | **0.74** | **20** |
| | **Total for all Findings:** | **$21,138** | **$7,739** | **2.73** | **$0** | **2.73** | **62** |



PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Garvey Commons

| | | | |
|---|---|---|---|
| FWB Number: | 11602 | Eco Number: | 1 |
| Site: | St Cloud SU | Date/Time Created: | 1/20/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over heating. | Date Identified: | 2/16/2011 |
| Description of Finding: | Steam unit heater (Air-Therm HS-110) pneumatic control line is disconnected from existing T-stat. The unit heater has no steam control valve and was intended to "run wild" and use fan cycling via a T-stat to control space temperature. The fan and steam heat run 24/7 due to disconnected pneumatic line and no control valve. As with most heating equipment, this unit heater fails in full heat mode. | | |
| Equipment or System(s): | Other | Finding Category: | Controls Problems |
| Finding Type: | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | | |

| | |
|---|---|
| Implementer: | Controls contractor |
| Benefits: | Energy savings & comfort |
| Baseline Documentation Method: | Visual inspection, traced tubing and found cut tubing. The mechanical penthouse was uncomfortably warm when the outside temperature was less than 20º F indicating overheating of the space. |
| Measure: | Provide new DDC temperature sensor, 2 position (on/off) steam control valve , and associated items (such as vacuum breaker, strainer, etc.) to take full control of the unit heater. |
| Recommendation for Implementation: | Provide new DDC temperature sensor, 2 position (on/off) steam control valve , and associated items (such as vacuum breaker, strainer, etc.) to control space to 60 degrees F. Add 4 points to the BAS, command, motor status, valve status and space temperature. These points shall be trended. |
| Evidence of Implementation Method: | Trend the following points: Unit command, motor status, valve status and space temperature at 15 minute intervals for a 2 week period minimum during the winter (heating season) December - February and the summer (cooling season) June - August to ensure the unit is running and maintaining 60 degree setpoint temperature during the winter and that the unit is not operating when the space temperature is above 60 degrees F. |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 330 | Annual Natural Gas Savings (therms): | 3,491 |
| Estimated Annual kWh Savings ($): | $17 | Estimated Annual Natural Gas Savings ($): | $2,608 |
| Contractor Cost ($): | $1,681 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $252 | | |
| Total Estimated Implementation Cost ($): | $1,934 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $2,624 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.74 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.74 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 20 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 2.6% | Percent of Implementation Costs: | 0.4% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Garvey Commons

| | | | |
|---|---|---|---|
| FWB Number: | 11602 | Eco Number: | 4 |
| Site: | St Cloud SU | Date/Time Created: | 1/20/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Infiltration due to deteriorated or missing damper seals (AHU-1 &2). | Date Identified: | 2/16/2011 |
| Description of Finding: | OA damper blade seals are missing, leaving about 1/2" gap between each 6" damper blade open to the outside. This is the equivalent leaving a window open when the building is unoccupied and the dampers are commanded to be closed. Cold air will infiltrate at lower levels of the building, be heated and exfiltrate through the partially open damper. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Maintenance Related Problems |
| Finding Type: | Leaky/Stuck Damper | | |

| | | | |
|---|---|---|---|
| Implementer: | Mechanical contractor | Benefits: | Energy savings and freeze protection |
| Baseline Documentation Method: | This deficiency was identified during a visual inspection of the OA damper from the inside of the AHU when shut down. OA dampers should be normally closed when the unit is off.. | | |
| Measure: | Replace missing or defective OA damper blade seals and adjust dampers to close tightly when commanded closed. | | |
| Recommendation for Implementation: | Replace OA damper seals and adjust damper operator to fully close and minimize infiltration and exfiltration. | | |
| Evidence of Implementation Method: | Visual inspection of damper blades when unit is disabled and off. | | |

| | | | |
|---|---|---|---|
| Annual Natural Gas Savings (therms): | 294 | Contractor Cost ($): | $1,233 |
| Estimated Annual Natural Gas Savings ($): | $219 | PBEEEP Provider Cost for Implementation Assistance ($): | $185 |
| | | Total Estimated Implementation Cost ($): | $1,418 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $219 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 6.46 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 6.46 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 2 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.2% | Percent of Implementation Costs: | 0.3% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Garvey Commons

| | | | |
|---|---|---|---|
| FWB Number: | 11602 | Eco Number: | 5 |
| Site: | St Cloud SU | Date/Time Created: | 1/20/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Damaged steam coil (AHU-3). | Date Identified: | 2/18/2011 |
| Description of Finding: | The steam heating coil in AHU-3 is leaking. There was a visible, high velocity stream emanating from a hole in the coil. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Maintenance Related Problems |
| Finding Type: | Other Maintenance | | |

| | | | |
|---|---|---|---|
| Implementer: | Mechanical contractor | Benefits: | Energy savings |
| Baseline Documentation Method: | Visual inspection of inside of AHU with supply and return fans off. | | |
| Measure: | leaking steam coil. | | |
| Recommendation for Implementation: | Repair steam coil. | | |
| Evidence of Implementation Method: | Visual inspection of repaired steam coil with supply and return fans off and steam valve open. | | |

| | | | |
|---|---|---|---|
| Annual Natural Gas Savings (therms): | 231 | Contractor Cost ($): | $1,257 |
| Estimated Annual Natural Gas Savings ($): | $172 | PBEEEP Provider Cost for Implementation Assistance ($): | $189 |
| | | Total Estimated Implementation Cost ($): | $1,446 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $172 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 8.39 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 8.39 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 1 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.2% | Percent of Implementation Costs: | 0.3% |

# Findings Details

## Building: Garvey Commons

| | | | |
|---|---|---|---|
| FWB Number: | 11602 | Eco Number: | 6 |
| Site: | St Cloud SU | Date/Time Created: | 1/20/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | 32 Watt T8 Lighting. | Date Identified: | 2/18/2011 |
| Description of Finding: | 32 Watt T8 Lamps were found throughout the building. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 32 watt T8 lamps are being installed. | | |
| Measure: | Replace 32 watt lamps with 28 watt lamps. | | |
| Recommendation for Implementation: | Replace the 32 watt T8 lamps with 28 watt T8 lamps throughout the building. | | |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 28 watt T8 lamps are being installed. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 46,217 | Peak Demand Savings (kWh): | 21 |
| Estimated Annual kWh Savings ($): | $2,630 | Estimated Annual Demand Savings ($): | $2,092 |
| Contractor Cost ($): | $14,209 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $2,131 | | |
| Total Estimated Implementation Cost ($): | $16,340 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $4,723 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 3.46 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 3.46 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 40 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 4.6% | Percent of Implementation Costs: | 3.1% |

# Findings Summary

## Building: Halenbeck Hall North
## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 2 | HW valves open excessively. | $460 | $116 | 3.98 | $0 | 3.98 | 1 |
| 3 | 32 Watt T8 Lighting. | $1,340 | $312 | 4.29 | $0 | 4.29 | 3 |
| 4 | 400 Watt Metal Halide fixtures. | $5,399 | $441 | 12.24 | $0 | 12.24 | 2 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$7,200** | **$869** | **8.28** | **$0** | **8.28** | **7** |

# Findings Details

## Building: Halenbeck Hall North

| | | | |
|---|---|---|---|
| FWB Number: | 11603 | Eco Number: | 2 |
| Site: | St Cloud SU | Date/Time Created: | 1/26/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | HW valves open excessively. | Date Identified: | 2/18/2011 |
| Description of Finding: | AHU heating valves (AHUs 12 through 21, serving the main gymnasium) are wide open almost continuously while units operate only a few hours per week and have a limited risk of freeze up. Existing mixed air temperature sensors could be used for freeze protection. The units are manually actuated, are used only 18% of the time, per trend data, and are not deactivated until the outside temperature exceeds 50 degrees. | | |
| Equipment or System(s): | AHU with heating only | Finding Category: | Controls Problems |
| Finding Type: | Other Controls | | |

| | | | |
|---|---|---|---|
| Implementer: | Control contractor | Benefits: | Elimination of wasted heat in the idled units. |
| Baseline Documentation Method: | Trend data indicates that valves are 100% open and plenum temperatures often exceed 100º F. The observed method of operation was supported by staff interviews. | | |
| Measure: | Close heating valves when fans are turned off unless required to prevent coil freezing. | | |
| Recommendation for Implementation: | Program heating valves to close unless temperatures inside the unit, as measured by the mixed air sensor, fall to near freezing (40 degrees F) temperatures. This change is only applicable to times when the unit is off. | | |
| Evidence of Implementation Method: | Visual observation & review of trend data to verify that HW valves close and the MA temperature sensors readings do not significantly exceed room temperature. | | |

| | | | |
|---|---|---|---|
| Annual Natural Gas Savings (therms): | 183 | Contractor Cost ($): | $400 |
| Estimated Annual Natural Gas Savings ($): | $116 | PBEEEP Provider Cost for Implementation Assistance ($): | $60 |
| | | Total Estimated Implementation Cost ($): | $460 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $116 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 3.98 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 3.98 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 1 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.1% | Percent of Implementation Costs: | 0.1% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Halenbeck Hall North

| | | | |
|---|---|---|---|
| FWB Number: | 11603 | Eco Number: | 3 |
| Site: | St Cloud SU | Date/Time Created: | 1/26/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | 32 Watt T8 Lighting. | Date Identified: | 2/18/2011 |
| Description of Finding: | 32 Watt T8 Lamps were found throughout the building. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps conlcuded 32 watt T8 lamps are being installed. | | |
| Measure: | Replace 32 watt lamps with 28 watt lamps. | | |
| Recommendation for Implementation: | Replace the 32 watt T8 lamps with 28 watt T8 lamps throughout the building. | | |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 28 watt T8 lamps are being installed. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 3,725 | Peak Demand Savings (kWh): | 2 |
| Estimated Annual kWh Savings ($): | $219 | Estimated Annual Demand Savings ($): | $93 |
| Contractor Cost ($): | $1,166 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $175 | | |
| Total Estimated Implementation Cost ($): | $1,340 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $312 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 4.29 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 4.29 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 3 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.3% | Percent of Implementation Costs: | 0.3% |

# Findings Details

## Building: Halenbeck Hall North

| | | | |
|---|---|---|---|
| FWB Number: | 11603 | Eco Number: | 4 |
| Site: | St Cloud SU | Date/Time Created: | 1/26/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | 400 Watt Metal Halide fixtures. | Date Identified: | 2/18/2011 |
| Description of Finding: | 400 watt metal halide fixtures were found in the swimming pool room. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps conlcuded 400 watt metal halide fixtures are being installed. | | |
| Measure: | Replace 400 watt metal halide lamps with 320 watt pulse start metal halide lamps. | | |
| Recommendation for Implementation: | Replace 400 watt metal halide lamps with 320 watt pulse start metal halide lamps. | | |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 320 watt watt pulse start metal halide lamps are being installed. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 2,819 | Peak Demand Savings (kWh): | 5 |
| Estimated Annual kWh Savings ($): | $158 | Estimated Annual Demand Savings ($): | $283 |
| Contractor Cost ($): | $4,695 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $704 | | |
| Total Estimated Implementation Cost ($): | $5,399 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $441 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 12.24 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 12.24 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 2 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.4% | Percent of Implementation Costs: | 1.0% |

# Findings Summary

PBEEEP State Government

Building: Halenbeck Hall South
Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 1 | Over scheduling. | $73 | $381 | 0.19 | $0 | 0.19 | 5 |
| 5 | 32 Watt T8 Lighting. | $904 | $185 | 4.89 | $0 | 4.89 | 2 |
| 4 | Infiltration due to OA damper leaking (AHU-9 & 10). | $4,235 | $444 | 9.54 | $0 | 9.54 | 4 |
| 6 | No Lighting Controls. | $3,675 | $64 | 57.39 | $0 | 57.39 | 1 |
| | **Total for Findings with Payback 3 years or less:** | **$73** | **$381** | **0.19** | **$0** | **0.19** | **5** |
| | **Total for all Findings:** | **$8,887** | **$1,074** | **8.27** | **$0** | **8.27** | **12** |



PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Halenbeck Hall South

| | | | |
|---|---|---|---|
| FWB Number: | 11604 | Eco Number: | 1 |
| Site: | St Cloud SU | Date/Time Created: | 1/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over scheduling. | Date Identified: | 4/4/2011 |
| Description of Finding: | Air handling units 7, 9, & 10 were found to be starting earlier than necessary. Building opens at 6am (M-F) 9am Saturday and noon on Sunday. Match the AHU start times to correspond to the building opening hours. | | |
| Equipment or System(s): | AHU with heating only | Finding Category: | Equipment Scheduling and Enabling |
| Finding Type: | Time of Day enabling is excessive | | |

| | |
|---|---|
| Implementer: | Control contractor |
| Benefits: | Save Energy via reduction of AHU runtime |
| Baseline Documentation Method: | AHU start time in BAS schedule and published building schedule. |
| Measure: | Revise AHU-7, 9 & 10 start times to match building opening hours. Building opens at 6am (M-F) 9am Saturday and noon on Sunday. |
| Recommendation for Implementation: | Revise AHU-7, 9 & 10 start times to match building opening hours. Building opens at 6am (M-F) 9am Saturday and noon on Sunday. Further adjustments of the HVAC equipment operating schedules should be implemented during periods of reduced occupancy, such as breaks, holidays, and summer school. The exact dates of these periods vary and will need to checked after the school calendar and building hours are published. |
| Evidence of Implementation Method: | BAS trend logs will provide the evidence that confirms the revised operating schedule. Trend the supply fan status for AHU-7, 9, and 10 at 15 minute intervals for two weeks while school is in session and a week while school is out of session. Verify with trend data that the AHUs only operate per the official building hours |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 4,328 | Annual Natural Gas Savings (therms): | 319 |
| Estimated Annual kWh Savings ($): | $180 | Estimated Annual Natural Gas Savings ($): | $202 |
| Contractor Cost ($): | $66 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $7 | | |
| Total Estimated Implementation Cost ($): | $73 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $381 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.19 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.19 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 5 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.4% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Halenbeck Hall South

| | | | |
|---|---|---|---|
| FWB Number: | 11604 | Eco Number: | 4 |
| Site: | St Cloud SU | Date/Time Created: | 1/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Infiltration due to OA damper leaking (AHU-9 & 10). | Date Identified: | 4/4/2011 |
| Description of Finding: | During night cycles, the mixed air temperature reading drops below 20 degrees in some cases. The outside air damper is remaining open or leaks excessively (AHU-9 and 10). | | |
| Equipment or System(s): | AHU with heating only | Finding Category: | Maintenance Related Problems |
| Finding Type: | Leaky/Stuck Damper | | |

| | | | |
|---|---|---|---|
| Implementer: | Control contractor | Benefits: | Reduce infiltration of unconditioned outside air during off cycles |
| Baseline Documentation Method: | OA damper position and mixed air trends. | | |
| Measure: | Replace existing OA damper with low leak motorized dampers for steam heating units; AHU-9 & 10 | | |
| Recommendation for Implementation: | Replace existing OA damper with low leak motorized dampers for steam heating units; AHU-9 & 10. | | |
| Evidence of Implementation Method: | Functional performance test the dampers to ensure that they close completely when commanded to do so. Also, trend the supply fan status, OA damper position, MAT, and OAT for AHU-9 and 10 at 15 minute intervals during the winter when the OAT is at or below freezing during unoccupied hours for at least 5 nights. Verify with trend data that the MAT does not drop significantly during these cold conditions when each unit is off, indicating that the dampers are no longer allowing infiltration into the AHUs. | | |

| | | | |
|---|---|---|---|
| Annual Natural Gas Savings (therms): | 702 | Contractor Cost ($): | $3,682 |
| Estimated Annual Natural Gas Savings ($): | $444 | PBEEEP Provider Cost for Implementation Assistance ($): | $552 |
| | | Total Estimated Implementation Cost ($): | $4,235 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $444 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 9.54 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 9.54 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 4 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.4% | Percent of Implementation Costs: | 0.8% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Halenbeck Hall South

| | | | |
|---|---|---|---|
| FWB Number: | 11604 | Eco Number: | 5 |
| Site: | St Cloud SU | Date/Time Created: | 1/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | 32 Watt T8 Lighting. | Date Identified: | 4/4/2011 |
| Description of Finding: | 32 Watt T8 Lamps were found throughout the building. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 32 watt T8 lamps are being installed. | | |
| Measure: | Replace 32 watt lamps with 28 watt lamps. | | |
| Recommendation for Implementation: | Replace the 32 watt T8 lamps with 28 watt T8 lamps throughout the building. | | |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 28 watt T8 lamps are being installed. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 2,248 | Peak Demand Savings (kWh): | 1 |
| Estimated Annual kWh Savings ($): | $132 | Estimated Annual Demand Savings ($): | $53 |
| Contractor Cost ($): | $822 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $82 | | |
| Total Estimated Implementation Cost ($): | $904 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $185 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 4.89 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 4.89 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 2 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.2% | Percent of Implementation Costs: | 0.2% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Halenbeck Hall South

| | | | |
|---|---|---|---|
| FWB Number: | 11604 | Eco Number: | 6 |
| Site: | St Cloud SU | Date/Time Created: | 1/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | No Lighting Controls. | Date Identified: | 4/4/2011 |
| Description of Finding: | No lighting controls were found and lights were on in several areas when they were unoccupied. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Equipment Scheduling and Enabling |
| Finding Type: | Lighting is on more hours than necessary | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of rooms indicates occupancy sensors are not being utilized. | | |
| Measure: | Installation of occupancy sensors found to be not economically feasible, please see recommendations for implementation for additional documentation. | | |
| Recommendation for Implementation: | Complete analysis showed energy savings below 25,000 kWh and extended paybacks (in excess of 50 years). | | |
| Evidence of Implementation Method: | Determined not economically feasible. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 1,089 | Contractor Cost ($): | $3,341 |
| Estimated Annual kWh Savings ($): | $64 | PBEEEP Provider Cost for Implementation Assistance ($): | $334 |
| | | Total Estimated Implementation Cost ($): | $3,675 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $64 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 57.39 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 57.39 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 1 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.1% | Percent of Implementation Costs: | 0.7% |

# Findings Summary

PBEEEP State Government

## Building: Heating
## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 4 | Uninsulated steam and condensate piping. | $8,918 | $3,435 | 2.60 | $0 | 2.60 | 30 |
| 5 | 32 Watt T8 Lighting. | $705 | $131 | 5.39 | $0 | 5.39 | 1 |
| 7 | 400 Watt Metal Halide fixtures. | $8,172 | $1,441 | 5.67 | $0 | 5.67 | 15 |
| 1 | Combustion air heating. | $204,517 | $25,158 | 8.13 | $0 | 8.13 | 220 |
| | **Total for Findings with Payback 3 years or less:** | **$8,918** | **$3,435** | **2.60** | **$0** | **2.60** | **30** |
| | **Total for all Findings:** | **$222,312** | **$30,165** | **7.37** | **$0** | **7.37** | **267** |



PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Heating

| | | | |
|---|---|---|---|
| FWB Number: | 11605 | Eco Number: | 1 |
| Site: | St Cloud SU | Date/Time Created: | 1/26/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Combustion air heating. | Date Identified: | 2/17/2011 |
| Description of Finding: | Currently using direct (gas) fired make-up air unit for combustion air. | | |
| Equipment or System(s): | Boiler Plant | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Energy/Heat Recovery | | |

| | | | |
|---|---|---|---|
| Implementer: | Mechanical contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of direct fired combustion air unit and interview with boiler operators. Dedicated gas meter for the combustion air unit. | | |
| Measure: | Recover waste heat from boiler stack to heat combustion air for boiler operation. | | |
| Recommendation for Implementation: | Install energy recovery heat exchanger in existing combustion air unit. Route flue exhaust through heat exchanger to collect waste heat, select equipment to provide 120 degree F temperature rise at 35,000 CFM air flow. | | |
| Evidence of Implementation Method: | Provide discharge air temperature sensor, to prove heat from energy recovery and trend for 2 weeks when outdoor air temperature is below 25 degrees F. Provide flow switch in the gas line and trend the gas flow (should be no flow) for the same 2 weeks as the discharge air temperature. | | |

| | | | |
|---|---|---|---|
| Annual Natural Gas Savings (therms): | 39,807 | Contractor Cost ($): | $177,841 |
| Estimated Annual Natural Gas Savings ($): | $25,158 | PBEEEP Provider Cost for Implementation Assistance ($): | $26,676 |
| | | Total Estimated Implementation Cost ($): | $204,517 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $25,158 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 8.13 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 8.13 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 220 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 24.6% | Percent of Implementation Costs: | 39.2% |

# Findings Details

## Building: Heating

| | | | |
|---|---|---|---|
| FWB Number: | 11605 | Eco Number: | 4 |
| Site: | St Cloud SU | Date/Time Created: | 1/26/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Uninsulated steam and condensate piping. | Date Identified: | 2/16/2011 |
| Description of Finding: | Insulation not found in the boiler room on 100' of 2" low pressure steam (LPS) pipe, 25' of 6" LPS pipe, and 10' of 4" LPS pipe. Insulation not found on 2 elbows of 8" high pressure steam pipe. Insulation not found on 30' of 4" condensate return pipe. | | |
| Equipment or System(s): | Boiler Plant | Finding Category: | Maintenance Related Problems |
| Finding Type: | Other Maintenance | | |

| | | | |
|---|---|---|---|
| Implementer: | Mechanical contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of the piping system. Interviews with building staff concluded that these pipes have never been insulated. | | |
| Measure: | Add insulation to piping and pipe accessories. | | |
| Recommendation for Implementation: | Add insulation in the boiler room to the uninsulated section to pipe. descriptions listen below: -100' of 2" low pressure steam (LPS) pipe, insulate with 2" of 650F Min Fiber Pipe and Tank, Type II and an All Service Jacket. -25' of 6" LPS pipe, insulate with 3" of 650F Min Fiber Pipe and Tank, Type II and an All Service Jacket. -10' of 4" LPS pipe, insulate with 3" of 650F Min Fiber Pipe and Tank, Type II and an All Service Jacket. -2 elbows of 8" high pressure steam pipe, insulate with 2" 650F Min Fiber Pipe and Tank, Type II and canvas finish. -30' of 4" condensate return pipe, insulate with 1.5" of 650F Min Fiber Pipe and Tank, Type II and an All Service Jacket. | | |
| Evidence of Implementation Method: | Visual inspection of the piping system. Interviews with building staff to ensure all piping gets insulated in the boiler room. | | |

| | | | |
|---|---|---|---|
| Annual Natural Gas Savings (therms): | 5,435 | Contractor Cost ($): | $7,755 |
| Estimated Annual Natural Gas Savings ($): | $3,435 | PBEEEP Provider Cost for Implementation Assistance ($): | $1,163 |
| | | Total Estimated Implementation Cost ($): | $8,918 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $3,435 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 2.60 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 2.60 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 30 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 3.4% | Percent of Implementation Costs: | 1.7% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Heating

| | | | |
|---|---|---|---|
| FWB Number: | 11605 | Eco Number: | 5 |
| Site: | St Cloud SU | Date/Time Created: | 1/26/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | 32 Watt T8 Lighting. | Date Identified: | 2/18/2011 |
| Description of Finding: | 32 Watt T8 Lamps were found throughout the building. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 32 watt T8 lamps are being installed. | | |
| Measure: | Replace 32 watt lamps with 28 watt lamps. | | |
| Recommendation for Implementation: | Replace the 32 watt T8 lamps with 28 watt T8 lamps throughout the building. | | |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 28 watt T8 lamps are being installed. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 1,252 | Contractor Cost ($): | $613 |
| Estimated Annual kWh Savings ($): | $72 | PBEEEP Provider Cost for Implementation Assistance ($): | $92 |
| | | Total Estimated Implementation Cost ($): | $705 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $131 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 5.39 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 5.39 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 1 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.1% | Percent of Implementation Costs: | 0.1% |

# Findings Details

## Building: Heating

| | | | |
|---|---|---|---|
| FWB Number: | 11605 | Eco Number: | 7 |
| Site: | St Cloud SU | Date/Time Created: | 1/26/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | 400 Watt Metal Halide fixtures. | Date Identified: | 2/18/2011 |
| Description of Finding: | 400 watt metal halide fixtures were found in the garage work areas. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 400 watt metal halide fixtures are being installed. | | |
| Measure: | Replace 400 watt metal halide fixtures with 6 lamp (32 watt) High Output T8 fixtures. | | |
| Recommendation for Implementation: | Replace (20) 400 watt metal halide fixtures with 32 watt 6 lamp high ballast factor T8 fixtures. The high ballast factor fixture will ensure there is appropriate light levels throughout the space. | | |
| Evidence of Implementation Method: | Visually inspect the fixtures to ensure 6 lamp (32 watt) high output T8 fixtures are being installed. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 17,550 | Peak Demand Savings (kWh): | 8 |
| Estimated Annual kWh Savings ($): | $975 | Estimated Annual Demand Savings ($): | $466 |
| Contractor Cost ($): | $7,106 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $1,066 | | |
| Total Estimated Implementation Cost ($): | $8,172 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $1,441 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 5.67 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 5.67 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 15 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 1.4% | Percent of Implementation Costs: | 1.6% |

# Findings Summary

## Building: James W. Miller LRC
## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 6 | Over scheduling. AHU-2 | $397 | $3,304 | 0.12 | $0 | 0.12 | 52 |
| 3 | Over scheduling. AHU-1 | $397 | $2,124 | 0.19 | $0 | 0.19 | 41 |
| 8 | Over scheduling. AHU-3 | $132 | $145 | 0.91 | $0 | 0.91 | 3 |
| 11 | Over scheduling. AHU-4 | $132 | $73 | 1.82 | $0 | 1.82 | 1 |
| 1 | 32 Watt T8 Lighting. | $33,835 | $7,922 | 4.27 | $0 | 4.27 | 78 |
| 2 | No Lighting Controls. | $37,571 | $7,253 | 5.18 | $0 | 5.18 | 139 |
| | **Total for Findings with Payback 3 years or less:** | **$1,058** | **$5,646** | **0.19** | **$0** | **0.19** | **97** |
| | **Total for all Findings:** | **$72,465** | **$20,822** | **3.48** | **$0** | **3.48** | **314** |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 1 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | 32 Watt T8 Lighting. | Date Identified: | 2/18/2011 |
| Description of Finding: | 32 Watt T8 Lamps were found throughout the building. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 32 watt T8 lamps are being installed. | | |
| Measure: | Replace 32 watt lamps with 28 watt lamps. | | |
| Recommendation for Implementation: | Replace the 32 watt T8 lamps with 28 watt T8 lamps throughout the building (3,938 total). | | |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 28 watt T8 lamps are being installed. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 90,853 | Peak Demand Savings (kWh): | 33 |
| Estimated Annual kWh Savings ($): | $5,636 | Estimated Annual Demand Savings ($): | $2,286 |
| Contractor Cost ($): | $29,422 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $4,413 | | |
| Total Estimated Implementation Cost ($): | $33,835 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $7,922 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 4.27 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 4.27 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 78 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 7.7% | Percent of Implementation Costs: | 6.5% |

# Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 2 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | No Lighting Controls. | Date Identified: | 2/18/2011 |
| Description of Finding: | No lighting controls were found and lights were on in several areas when they were unoccupied. Interviews with the building manager indicates the lights are on 24 hrs a day 7 days a week. Also, the building manager has the only lighting controls for this building and said he never turns the lights off. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Equipment Scheduling and Enabling |
| Finding Type: | Lighting is on more hours than necessary | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of rooms indicates occupancy sensors are not used. | | |
| Measure: | Install Occupancy Sensors. | | |
| Recommendation for Implementation: | Install 88 Occupancy Sensors throughout the building to control lighting. It is recommended to use a 20 min time delay for these sensors. However, if a shorter time delay is used, this will result in more energy savings. | | |
| Evidence of Implementation Method: | Visually inspect the building to ensure occupancy sensors are installed in appropriate locations. Use Light Loggers in a sample area to determine whether lights actually do turn off according to space needs. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 161,903 | Contractor Cost ($): | $32,671 |
| Estimated Annual kWh Savings ($): | $7,253 | PBEEEP Provider Cost for Implementation Assistance ($): | $4,901 |
| | | Total Estimated Implementation Cost ($): | $37,571 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $7,253 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 5.18 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 5.18 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 139 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 7.1% | Percent of Implementation Costs: | 7.2% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 3 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over scheduling. AHU-1 | Date Identified: | 2/18/2011 |
| Description of Finding: | AHU-1 is operated continuously while the area served is only open for 113 of the 168 hours in a week. The system static pressure is set for 1.96" wc on the day cycle and reduced to 0.8" at night/unoccupied. The posted school year opening time for this building is 7:30 AM Monday through Friday, 10:00 AM on Saturday and 11:00 AM on Sunday. The building closes at 2:00 AM Sunday through Thursday, 7:00 PM Friday and 8:00 PM on Saturday. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Equipment Scheduling and Enabling |
| Finding Type: | Equipment is enabled regardless of need, or such enabling is excessive | | |

| | | | |
|---|---|---|---|
| Implementer: | Control contractor | Benefits: | Fan energy use will be eliminated 55 hours per week. |
| Baseline Documentation Method: | Visual, staff interviews & trend data confirm continuous operation and static pressure reduction at night. Trend data indicates that the unit maintains a duct static pressure continuously, but at reduced level when the building occupancy is low or the building closed. During a normal school year week, the unit operates at approximately 48 hours of low static pressure. | | |
| Measure: | Reschedule AHU-1 to operate only during hours when the building is open or significantly staffed. | | |
| Recommendation for Implementation: | Reprogram the system to run only during scheduled occupancy and cycle on, as necessary, to maintain setback of 10ºF from the current setpoint of 70F. The current static pressure for the night operation is set to 0.8" (if unoccupied fan activation is required). During a typical academic week, the system should be put into day cycle at 7:00 AM, to accommodate academic staff, Monday through Friday, 10:00 AM on Saturday and 11:00 AM on Sunday. The system should be stopped at the posted closing time of 2:00 AM, Monday through Friday, 7:00 PM on Friday evening and 8:00 PM on Saturday. For 11 weeks during the summer the scheduled posted hours are 7:00 AM to 10 PM Monday through Friday, 7:00 AM to 4:00 PM Friday, closed Saturdays, and 2:00 PM to 10:00 PM Sundays. Train the staff to adjust the schedule to match reduced occupancy schedules during school year breaks and holidays for additional savings. | | |
| Evidence of Implementation Method: | Inspection of the temperature setpoints to ensure they are being set to 60F and 0.8" static pressure during the night. Inspect the scheduling section of the control system will indicate that the system is programmed to start and stop at the recommended times. A week of 15-minute trends of the fan status or duct static pressure for a typical mid-semester week, with normal class schedules, will provide evidence of compliance. Operation during school breaks or weeks with holidays offer additional savings, but are not required for this measure. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 47,402 | Contractor Cost ($): | $345 |
| Estimated Annual kWh Savings ($): | $2,124 | PBEEEP Provider Cost for Implementation Assistance ($): | $52 |
| | | Total Estimated Implementation Cost ($): | $397 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $2,124 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.19 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.19 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 41 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 2.1% | Percent of Implementation Costs: | 0.1% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 6 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over scheduling. AHU-2 | Date Identified: | 2/18/2011 |
| Description of Finding: | AHU-2 is operated continuously while the area served is only open for 110.5 of the 168 hours in a week. The system static pressure is set for 2" wc on the day cycle and reduced to 0.79" at night/unoccupied. The posted school year opening time for this building is 7:30 AM Monday through Friday, 10:00 AM on Saturday and 11:00 AM on Sunday. The building closes at 2:00 AM Sunday through Thursday, 7:00 PM Friday and 8:00 PM on Saturday. For 11 weeks during the summer the scheduled posted hours are 7:00 AM to 10 PM Monday through Friday, 7:00 AM to 4:00 PM Friday, closed Saturdays, and 2:00 PM to 10:00 PM Sundays. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Equipment Scheduling and Enabling |
| Finding Type: | Equipment is enabled regardless of need, or such enabling is excessive | | |

| | | | |
|---|---|---|---|
| Implementer: | Control contractor | Benefits: | Fan energy use will be eliminated 55 hours per week. |
| Baseline Documentation Method: | Visual, staff interviews & trend data confirm continuous operation and static pressure reduction at night. Trend data indicates that the unit maintains a duct static pressure continuously, but at reduced level when the building occupancy is low or the building closed. During a normal school year week, the unit operates at approximately 40 hours of low static pressure. | | |
| Measure: | Reschedule AHU-2 to operate only during hours when the building is open or significantly staffed. | | |
| Recommendation for Implementation: | Reprogram the system to run only during scheduled occupancy and cycle on, as necessary, to maintain setback of 10ºF from the current setpoint of 70F. The current static pressure for the night operation is set to 0.8" (if unoccupied fan activation is required). During a typical academic week, the system should be put into day cycle at 7:00 AM, to accommodate academic staff, Monday through Friday, 10:00 AM on Saturday and 11:00 AM on Sunday. The system should be stopped at the posted closing time of 2:00 AM, Monday through Friday, 7:00 PM on Friday evening and 8:00 PM on Saturday. For 11 weeks during the summer the scheduled posted hours are 7:00 AM to 10 PM Monday through Friday, 7:00 AM to 4:00 PM Friday, closed Saturdays, and 2:00 PM to 10:00 PM Sundays. Train the staff to adjust the schedule to match reduced occupancy schedules during school year breaks and holidays for additional savings. | | |
| Evidence of Implementation Method: | Inspection of the temperature setpoints to ensure they are being set to 60F and 0.8" static pressure during the night. Inspect the scheduling section of the control system will indicate that the system is programmed to start and stop at the recommended times. A week of 15-minute trends of the fan status or duct static pressure for a typical mid-semester week, with normal class schedules, will provide evidence of compliance. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 61,164 | Contractor Cost ($): | $345 |
| Estimated Annual kWh Savings ($): | $3,304 | PBEEEP Provider Cost for Implementation Assistance ($): | $52 |
| | | Total Estimated Implementation Cost ($): | $397 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $3,304 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.12 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.12 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 52 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 3.2% | Percent of Implementation Costs: | 0.1% |

# Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 8 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over scheduling. AHU-3 | Date Identified: | 2/18/2011 |
| Description of Finding: | AHU-2 is operated continuously while the area served is only open for 110.5 of the 168 hours in a week. The system static pressure is set for 2" wc on the day cycle and reduced to 0.79" at night/unoccupied. The posted school year opening time for this building is 7:30 AM Monday through Friday, 10:00 AM on Saturday and 11:00 AM on Sunday. The building closes at 2:00 AM Sunday through Thursday, 7:00 PM Friday and 8:00 PM on Saturday. For 11 weeks during the summer the scheduled posted hours are 7:00 AM to 10 PM Monday through Friday, 7:00 AM to 4:00 PM Friday, closed Saturdays, and 2:00 PM to 10:00 PM Sundays. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Equipment Scheduling and Enabling |
| Finding Type: | Equipment is enabled regardless of need, or such enabling is excessive | | |

| | | | |
|---|---|---|---|
| Implementer: | Control contractor | Benefits: | Fan energy use will be eliminated one hour per day. |
| Baseline Documentation Method: | Trend data was used to identify the method of operation VAV airflow, calculated OA percentage and damper positions are used in lieu of status points to verify AHU operating hours. Interviews with building personnel helped indicate current operations. | | |
| Measure: | Reschedule AHU-3 to operate only during hours when the building is open or significantly staffed. | | |
| Recommendation for Implementation: | Reprogram the system to start 0.5 hrs before the building is occupied and cycle on, as necessary, to maintain setback temperature or humidity requirements. The building are published on the SCSU web page. Program the unit to start operation 0.5 hrs before the posted schedule. The posted school year opening time for this building is 7:30 AM Monday through Friday, 10:00 AM on Saturday and 11:00 AM on Sunday. The building closes at 2:00 AM Sunday through Thursday, 7:00 PM Friday and 8:00 PM on Saturday. | | |
| Evidence of Implementation Method: | Inspection of the scheduling section of the control system will indicate that the system is programmed to start and stop at the recommended times. A week of 15-minute trends of the fan status or duct static pressure for a typical mid-semester week, with normal class schedules, will provide evidence of compliance. Operation during summer session, school breaks or weeks with holidays offer additional savings, but are not required for this measure. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 3,246 | Contractor Cost ($): | $115 |
| Estimated Annual kWh Savings ($): | $145 | PBEEEP Provider Cost for Implementation Assistance ($): | $17 |
| | | Total Estimated Implementation Cost ($): | $132 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $145 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.91 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.91 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 3 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.1% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 11 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over scheduling. AHU-4 | Date Identified: | 2/18/2011 |
| Description of Finding: | AHU-4 is placed in operation approximately 1 hour before the building opens for the day. OA is introduced to the system and heated or cooled during this hour as well. The posted school year opening time for this building is 7:30 AM Monday through Friday, 10:00 AM on Saturday and 11:00 AM on Sunday. The building closes at 2:00 AM Sunday through Thursday, 7:00 PM Friday and 8:00 PM on Saturday. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Equipment Scheduling and Enabling |
| Finding Type: | Equipment is enabled regardless of need, or such enabling is excessive | | |

| | | | |
|---|---|---|---|
| Implementer: | Control contractor | Benefits: | Fan energy use will be eliminated one hour per day. |
| Baseline Documentation Method: | Trend data was used to identify the method of operation VAV airflow, calculated OA percentage and damper positions are used in lieu of status points to verify AHU operating hours. Interviews with building personnel helped indicate current operations. | | |
| Measure: | Reschedule AHU-4 to operate only during hours when the building is open or significantly staffed. | | |
| Recommendation for Implementation: | Reprogram the system to start 0.5 hrs before the building is occupied and cycle on, as necessary, to maintain setback temperature or humidity requirements. The building are published on the SCSU web page. Program the unit to start operation 0.5 hrs before the posted schedule. The posted school year opening time for this building is 7:30 AM Monday through Friday, 10:00 AM on Saturday and 11:00 AM on Sunday. The building closes at 2:00 AM Sunday through Thursday, 7:00 PM Friday and 8:00 PM on Saturday. | | |
| Evidence of Implementation Method: | Inspection of the scheduling section of the control system will indicate that the system is programmed to start and stop at the recommended times. A week of 15-minute trends of the fan status or duct static pressure for a typical mid-semester week, with normal class schedules, will provide evidence of compliance. Operation during summer session, school breaks or weeks with holidays offer additional savings, but are not required for this measure. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 1,623 | Contractor Cost ($): | $115 |
| Estimated Annual kWh Savings ($): | $73 | PBEEEP Provider Cost for Implementation Assistance ($): | $17 |
| | | Total Estimated Implementation Cost ($): | $132 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $73 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 1.82 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 1.82 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 1 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.1% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Summary

## Building: Mitchell Hall
## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 2 | Inefficient Lighting. | $3,308 | $1,101 | 3.01 | $0 | 3.01 | 14 |
| 3 | Inefficient Lighting. | $4,006 | $700 | 5.72 | $0 | 5.72 | 7 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$7,313** | **$1,801** | **4.06** | **$0** | **4.06** | **21** |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# Findings Details

## Building: Mitchell Hall

| | | | |
|---|---|---|---|
| FWB Number: | 11607 | Eco Number: | 2 |
| Site: | St Cloud SU | Date/Time Created: | 1/20/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Inefficient Lighting. | Date Identified: | 2/18/2011 |
| Description of Finding: | 32 Watt T8 lamps were found in the corridors and common areas, Incandescent lamps were found in the maintenance closets. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 32 watt T8 lamps are being installed, as well as some Incandescent lamps. | | |
| Measure: | Replace 32 watt lamps with 28 watt lamps. Replace 60 watt incandescent lamps with 14 watt CFL. | | |
| Recommendation for Implementation: | Replace the 32 watt T8 lamps with 28 watt T8 lamps in the corridors and common areas. Per attachment 4 of the RFP Mitchell Hall information indicates 8760 hours of operation, this is consistent with interviews from building staff that indicates these areas always need to have light for safety reasons. Also, replace 60 watt incandescent lamps with 14 watt CFL in the maintenance closets. | | |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 28 watt T8 lamps are being installed, as well as compact fluorescent lamps. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 16,727 | Peak Demand Savings (kWh): | 4 |
| Estimated Annual kWh Savings ($): | $858 | Estimated Annual Demand Savings ($): | $242 |
| Contractor Cost ($): | $2,978 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $330 | | |
| Total Estimated Implementation Cost ($): | $3,308 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $1,101 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 3.01 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 3.01 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 14 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 1.1% | Percent of Implementation Costs: | 0.6% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Mitchell Hall

| | | | |
|---|---|---|---|
| FWB Number: | 11607 | Eco Number: | 3 |
| Site: | St Cloud SU | Date/Time Created: | 1/20/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Inefficient Lighting. | Date Identified: | 2/18/2011 |
| Description of Finding: | 32 Watt T8 lamps were found in the Dorm Rooms and Kitchen Areas. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 32 watt T8 lamps are being installed. | | |
| Measure: | Replace 32 watt lamps with 28 watt lamps. | | |
| Recommendation for Implementation: | Replace approximately 492 32 watt T8 lamps with 28 watt T8 lamps in the Dorm Room and Kitchen Areas. Hours will vary per dorm room, AMEC used past experience to determine average use. | | |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 28 watt T8 lamps are being installed. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 7,611 | Peak Demand Savings (kWh): | 4 |
| Estimated Annual kWh Savings ($): | $463 | Estimated Annual Demand Savings ($): | $237 |
| Contractor Cost ($): | $3,676 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $330 | | |
| Total Estimated Implementation Cost ($): | $4,006 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $700 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 5.72 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 5.72 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 7 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.7% | Percent of Implementation Costs: | 0.8% |

# Findings Summary

## Building: National Hockey Center

## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 5 | Desiccant Unit 2 Heating in Warm Weather | $1,650 | $5,029 | 0.33 | $0 | 0.33 | 50 |
| 4 | Desiccant Unit 2 Overuse in Cold Weather | $1,708 | $4,171 | 0.41 | $0 | 0.41 | 44 |
| 2 | High Bay Lobby Lighting | $16,697 | $3,541 | 4.72 | $0 | 4.72 | 41 |
| 1 | Inefficient Fluorescent Lighting | $5,019 | $533 | 9.41 | $0 | 9.41 | 6 |
| 3 | Lighting Controls | $10,262 | $799 | 12.84 | $0 | 12.84 | 12 |
| | **Total for Findings with Payback 3 years or less:** | **$3,358** | **$9,200** | **0.37** | **$0** | **0.37** | **94** |
| | **Total for all Findings:** | **$35,336** | **$14,073** | **2.51** | **$0** | **2.51** | **152** |



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# Findings Details

## Building: National Hockey Center

| | | | |
|---|---|---|---|
| FWB Number: | 11608 | Eco Number: | 1 |
| Site: | St Cloud SU | Date/Time Created: | 5/25/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Inefficient Fluorescent Lighting | Date Identified: | 2/18/2011 |
| Description of Finding: | 32 watt T8 lamps were found throughout the building. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | |
|---|---|
| Implementer: | Lighting contractor |
| Benefits: | Energy savings and load reduction. |
| Baseline Documentation Method: | Visual inspection of the lamps conlcuded 32 watt T8 lamps are being installed. |
| Measure: | Replace 32 watt lamps with 28 watt lamps. |
| Recommendation for Implementation: | Replace the 32 watt T8 lamps with 28 watt T8 lamps throughout the hallways. |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 28 watt T8 lamps are being installed. Submit invoice showing the lamps were purchased. |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 6,493 | Peak Demand Savings (kWh): | 3 |
| Estimated Annual kWh Savings ($): | $361 | Estimated Annual Demand Savings ($): | $172 |
| Contractor Cost ($): | $4,563 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $456 | | |
| Total Estimated Implementation Cost ($): | $5,019 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $533 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 9.41 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 9.41 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 6 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.5% | Percent of Implementation Costs: | 1.0% |

# Findings Details

## Building: National Hockey Center

| | | | |
|---|---|---|---|
| FWB Number: | 11608 | Eco Number: | 2 |
| Site: | St Cloud SU | Date/Time Created: | 5/25/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | High Bay Lobby Lighting | Date Identified: | 2/18/2011 |
| Description of Finding: | 400 watt metal halide fixtures were found in the main lobby areas. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor. | Benefits: | Energy savings and load reduction. |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 400 watt metal halide fixtures are being installed. | | |
| Measure: | Replace 400 watt metal halide lamps with 6 lamp T8 fixtures. | | |
| Recommendation for Implementation: | Replace 400 watt metal halide lamps with 6 lamp T8 fixtures. Fixtures shall have six 32 watt lamps each with a high efficiency ballast that is also a high ballast factor electronic model. The ballast/lamp combination is expected to have an input power of approximately 221 Watts. | | |
| Evidence of Implementation Method: | Visually inspect and submit photo and invoice of the 6 lamp T8 fixtures. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 47,532 | Peak Demand Savings (kWh): | 16 |
| Estimated Annual kWh Savings ($): | $2,643 | Estimated Annual Demand Savings ($): | $897 |
| Contractor Cost ($): | $15,179 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $1,518 | | |
| Total Estimated Implementation Cost ($): | $16,697 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $3,541 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 4.72 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 4.72 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 41 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 3.5% | Percent of Implementation Costs: | 3.2% |

# Findings Details

## Building: National Hockey Center

| | | | |
|---|---|---|---|
| FWB Number: | 11608 | Eco Number: | 3 |
| Site: | St Cloud SU | Date/Time Created: | 5/25/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Lighting Controls | Date Identified: | 2/18/2011 |
| Description of Finding: | No lighting controls were found and lights were on in several areas when they were unoccupied. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Equipment Scheduling and Enabling |
| Finding Type: | Lighting is on more hours than necessary | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings. |
| Baseline Documentation Method: | Visual inspection of rooms indicates occupancy sensors are not used. | | |
| Measure: | Install occupancy sensors. | | |
| Recommendation for Implementation: | Install occupancy sensors throughout the building to control lighting. It is recommended to use a 20 min time delay for these sensors. However, if a shorter time delay is used, this will result in more energy savings. | | |
| Evidence of Implementation Method: | Visually inspect the building to ensure occupancy sensors are installed in appropriate locations. Use light loggers in a sample area to determine whether lights actually do turn off according to space needs. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 14,367 | Contractor Cost ($): | $9,329 |
| Estimated Annual kWh Savings ($): | $799 | PBEEEP Provider Cost for Implementation Assistance ($): | $933 |
| | | Total Estimated Implementation Cost ($): | $10,262 |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $799 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 12.84 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 12.84 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 12 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.8% | Percent of Implementation Costs: | 2.0% |


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# Findings Details

## Building: National Hockey Center

| | | | |
|---|---|---|---|
| FWB Number: | 11608 | Eco Number: | 4 |
| Site: | St Cloud SU | Date/Time Created: | 5/25/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Desiccant Unit 2 Overuse in Cold Weather | Date Identified: | 3/23/2012 |
| Description of Finding: | Desiccant unit 2, serving the Practice Rink, operated continuously from October 17 through the end of data collection in January. This unit was dehumidifying over 99% of the time that the OA temperature was below 40º F and intermittently at warmer temperatures. This is inconsistent with the operation of desiccant unit 1 and the fact that cold OA is drier and dehumidification should not be required under those conditions. Per ASHRAE S24.6-2008, dehumidification should be used to maintain the dew point 15º below the space temperature to eliminate fog formation over the ice sheet. The space temperature is typically 50º F during winter weather. Since the dew point is by definition less that the dry bulb temperature, any time that the OA temperature is less than 40º F, desiccant dehumidification should not be required. This is also consistent with the operation of the adjacent main rink system. This is likely the result of the combination of a bad humidity sensor(s) and mix up between summer and winter control modes for the desiccant unit. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Controls Problems |
| Finding Type: | Other Controls | | |

| | | | |
|---|---|---|---|
| Implementer: | Temperature control contractor | Benefits: | Gas and electric energy savings. |
| Baseline Documentation Method: | Tren data analysis | | |
| Measure: | Fix winter operating mode and calibrate humidity control. | | |
| Recommendation for Implementation: | Calibrate humidity sensor(s) and change winter operating mode to allow heating with the post-heating coil and disable dehumidification. Make the setup of operating mode simple and clear for operators. Also limit winter time air handler operation to occupied hours (plus short-term response to thermostat calls for heat during unoccupied hours). | | |
| Evidence of Implementation Method: | Trend OA temperature, space temperature, space dew point or humidity, desiccant unit operation and desiccant unit discharge air temperature and relative humidity for a period of two weeks during November, December, January or February. The unit should not dehumidify when the OA temperature is les than 40º F, and should only operate as needed for ventilation during occupied hours and/or cycle for heating overnight. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 13,316 | Annual Natural Gas Savings (therms): | 5,902 |
| Estimated Annual kWh Savings ($): | $553 | Estimated Annual Natural Gas Savings ($): | $3,618 |
| Contractor Cost ($): | $1,258 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $450 | | |
| Total Estimated Implementation Cost ($): | $1,708 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $4,171 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.41 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.41 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 44 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 4.1% | Percent of Implementation Costs: | 0.3% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: National Hockey Center

| | | | |
|---|---|---|---|
| FWB Number: | 11608 | Eco Number: | 5 |
| Site: | St Cloud SU | Date/Time Created: | 5/25/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Desiccant Unit 2 Heating in Warm Weather | Date Identified: | 4/26/2012 |
| Description of Finding: | Desiccant unit 2, serving the Practice Rink, operated and heated air continuously during warmer weather. Even though the dehumidification operation cycled based on arena humidity, the post-heating coil caused continuous heating that overheated the arena to around 60ºF until the "summertime" operating mode was switched. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Controls Problems |
| Finding Type: | Other Controls | | |

| | |
|---|---|
| Implementer: | Temperature control contractor |
| Benefits: | Energy savings. |
| Baseline Documentation Method: | Tren data analysis |
| Measure: | Fix summer operating mode to prevent continuous heating. |
| Recommendation for Implementation: | Change summer operating mode to prevent continuous heating with the post-heating coil. Make the setup of operating mode simple and clear for operators. Also limit summertime air handler operation to occupied hours (plus short-term response to thermostat calls for heat during unoccupied hours). |
| Evidence of Implementation Method: | Trend OA temperature, space temperature, space dew point or humidity, desiccant unit operation and desiccant unit discharge air temperature and relative humidity for a period of two weeks during between May and September. At outdoor air temperatures above 50°F the unit should heat only as needed to maintain the arena temperature above the setpoint (expected to be 50°F or less), and should only operate as needed for ventilation during occupied hours and/or cycle for dehumidification or heating overnight. |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 9,069 | Annual Natural Gas Savings (therms): | 7,591 |
| Estimated Annual kWh Savings ($): | $376 | Estimated Annual Natural Gas Savings ($): | $4,653 |
| Contractor Cost ($): | $1,200 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $450 | | |
| Total Estimated Implementation Cost ($): | $1,650 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $5,029 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.33 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.33 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 50 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 4.9% | Percent of Implementation Costs: | 0.3% |

# Findings Summary

## Building: Husky Stadium
## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 1 | Excessive Enabling of AHU2. | $152 | $266 | 0.57 | $0 | 0.57 | 3 |
| 2 | 32 Watt T8 Lighting. | $1,615 | $284 | 5.68 | $0 | 5.68 | 3 |
| 4 | 250 Watt Metal Halide fixtures. | $12,093 | $1,417 | 8.53 | $0 | 8.53 | 15 |
| | **Total for Findings with Payback 3 years or less:** | **$152** | **$266** | **0.57** | **$0** | **0.57** | **3** |
| | **Total for all Findings:** | **$13,861** | **$1,968** | **7.04** | **$0** | **7.04** | **20** |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Husky Stadium

| | | | |
|---|---|---|---|
| FWB Number: | 11609 | Eco Number: | 1 |
| Site: | St Cloud SU | Date/Time Created: | 1/27/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Excessive Enabling of AHU2. | Date Identified: | 2/16/2011 |
| Description of Finding: | AHU-2 operates 24/7 during the fall sports season (Aug - Nov) and 3 hours per day (1pm - 4pm), 5 days per week (Mon - Fri), for the rest of the year. This is needed for the fall sports season, but not during the rest of the year. The fall season operating schedule is as was reported by campus maintenance staff. The off-season operating schedule was obtained by reviewing trend data and confirming the findings with the staff. We only used 5 days per week because special events on weekends frequently require additional run hours. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Equipment Scheduling and Enabling |
| Finding Type: | Time of Day enabling is excessive | | |

| | |
|---|---|
| Implementer: | Control contractor |
| Benefits: | Heating and cooling energy and cost savings. |
| Baseline Documentation Method: | Maintenance staff interviews and BAS schedule. Operation confirmed by trend data of AHU2 SF and RF. Operation over time shows the unit is on for 3 hours a day Mon-Fri during all times except the fall sports season. Winter weekend use is determined by special events scheduling and varies as necessary for the anticipated activities in the building. |
| Measure: | Reduce OA ventilation and fan operation by 1 hr per day (Mon - Fri) (3pm - 4pm). |
| Recommendation for Implementation: | During the fall sports season and winter weekends, keep the operation as it is presently scheduled. During all other seasons, reduce OA ventilation and fan operation of AHU2 by 1 hr per day (Mon - Fri) (3pm - 4pm). Further reductions should be tried as well. |
| Evidence of Implementation Method: | Trend AHU2 SF and RF Operation over time to ensure the unit shuts down between the hours of 3pm and 4pm Mon-Fri, excluding fall sports season (Aug - Nov). |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 1,178 | Annual Natural Gas Savings (therms): | 292 |
| Estimated Annual kWh Savings ($): | $81 | Estimated Annual Natural Gas Savings ($): | $185 |
| Contractor Cost ($): | $132 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $20 | | |
| Total Estimated Implementation Cost ($): | $152 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $266 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.57 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.57 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 3 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.3% | Percent of Implementation Costs: | 0.0% |

# Findings Details

## Building: Husky Stadium

| | | | |
|---|---|---|---|
| FWB Number: | 11609 | Eco Number: | 2 |
| Site: | St Cloud SU | Date/Time Created: | 1/27/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | 32 Watt T8 Lighting. | Date Identified: | 2/18/2011 |
| Description of Finding: | 32 Watt T8 Lamps were found throughout the building. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 32 watt T8 lamps are being installed. Used screenshots from building website to determine hours of operation. | | |
| Measure: | Replace 32 watt lamps with 28 watt lamps. | | |
| Recommendation for Implementation: | Replace the 32 watt T8 lamps with 28 watt T8 lamps throughout the building. | | |
| Evidence of Implementation Method: | Visually inspect the lamps to ensure 28 watt T8 lamps are being installed. | | |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 3,294 | Peak Demand Savings (kWh): | 2 |
| Estimated Annual kWh Savings ($): | $195 | Estimated Annual Demand Savings ($): | $90 |
| Contractor Cost ($): | $1,405 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $211 | | |
| Total Estimated Implementation Cost ($): | $1,615 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $284 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 5.68 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 5.68 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 3 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.3% | Percent of Implementation Costs: | 0.3% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Findings Details

## Building: Husky Stadium

| | | | |
|---|---|---|---|
| FWB Number: | 11609 | Eco Number: | 4 |
| Site: | St Cloud SU | Date/Time Created: | 1/27/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | 250 Watt Metal Halide fixtures. | Date Identified: | 2/18/2011 |
| Description of Finding: | 250 watt Metal Halide fixtures were found in the main corridor. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Retrofits |
| Finding Type: | Retrofit - Efficient Lighting | | |

| | |
|---|---|
| Implementer: | Lighting contractor |
| Benefits: | Energy savings and load reduction |
| Baseline Documentation Method: | Visual inspection of the lamps concluded 250 watt metal halide fixtures are being installed. |
| Measure: | Replace 250 watt metal halide fixtures with 4 lamp (32 watt) High Output T8 fixtures. |
| Recommendation for Implementation: | Replace 250 watt metal halide fixtures with 4 lamp (32 watt) T8 high ballast factor fixtures. The high ballast factor fixture will ensure there is appropriate light levels throughout the space. |
| Evidence of Implementation Method: | Visually inspect the fixtures to ensure 4 lamp (32 watt) high output T8 fixtures are being installed. |

| | | | |
|---|---|---|---|
| Annual Electric Savings (kWh): | 17,008 | Peak Demand Savings (kWh): | 6 |
| Estimated Annual kWh Savings ($): | $972 | Estimated Annual Demand Savings ($): | $445 |
| Contractor Cost ($): | $10,516 | | |
| PBEEEP Provider Cost for Implementation Assistance ($): | $1,577 | | |
| Total Estimated Implementation Cost ($): | $12,093 | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $1,417 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 8.53 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 8.53 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 15 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 1.4% | Percent of Implementation Costs: | 2.3% |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11601 - SCSU- Central Chilled Water Plant

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| a. Equipment Scheduling and Enabling: | a.1 (1) | Time of Day enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.3 (3) | Lighting is on more hours than necessary. | | | Investigation looked for, but did not find this issue. | |
| | a.4 (4) | OTHER_Equipment Scheduling/Enabling | | | Investigation looked for, but did not find this issue. | |
| b. Economizer/Outside Air Loads: | b.1 (5) | Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized) | | | Not Relevant | |
| | b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy. | | | Not Relevant | |
| | b.3 (7) | OTHER_Economizer/OA Loads | | | Not Relevant | |
| c. Controls Problems: | c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | | Not Relevant | |
| | c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | | | Not Relevant | |
| | c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | | Investigation looked for, but did not find this issue. | |
| | c.4 (11) | OTHER_Controls | | | Investigation looked for, but did not find this issue. | |
| d. Controls (Setpoint Changes): | d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | | Not Relevant | |
| | d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | | Not Relevant | |
| | d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | | Not Relevant | |
| | d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | |
| | d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | | Not Relevant | |
| | d.6 (17) | Other_Controls (Setpoint Changes) | | | Investigation looked for, but did not find this issue. | |
| e. Controls (Reset Schedules): | e.1 (18) | HW Supply Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.2 (19) | CHW Supply Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.3 (20) | Supply Air Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.4 ( ) | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.5 (21) | Condenser Water Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.6 (22) | Other_Controls (Reset Schedules) | | | Investigation looked for, but did not find this issue. | |
| f. Equipment Efficiency Improvements / Load Reduction: | f.1 (23) | Daylighting Control needs optimization—Spaces are Over-Lit | | | Investigation looked for, but did not find this issue. | |
| | f.2 (24) | Pump Discharge Throttled | | | Investigation looked for, but did not find this issue. | |
| | f.3 (25) | Over-Pumping | X | Throughout Campus | | Yes, but solution exceeds project scope |
| | f.4 (26) | Equipment is oversized for load. | | | Investigation looked for, but did not find this issue. | |
| | f.5 (27) | OTHER_Equipment Efficiency/Load Reduction | | | Investigation looked for, but did not find this issue. | |
| | g.1 (28) | VFD Retrofit - Fans | | | Not Relevant | |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11601 - SCSU- Central Chilled Water Plant

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| g. Variable Frequency Drives (VFD): | g.2 (29) | VFD Retrofit - Pumps | | | Investigation looked for, but did not find this issue. | |
| | g.3 (30) | VFD Retrofit - Motors (process) | | | Not Relevant | |
| | g.4 (31) | OTHER_VFD | | | Investigation looked for, but did not find this issue. | |
| h. Retrofits: | h.1 (32) | Retrofit - Motors | | | Investigation looked for, but did not find this issue. | |
| | h.2 (33) | Retrofit - Chillers | | | Investigation looked for, but did not find this issue. | |
| | h.3 (34) | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | | Not Relevant | |
| | h.4 (35) | Retrofit - Boilers | | | Not Relevant | |
| | h.5 (36) | Retrofit - Packaged Gas fired heating | | | Not Relevant | |
| | h.6 (37) | Retrofit - Heat Pumps | | | Not Relevant | |
| | h.7 (38) | Retrofit - Equipment (custom) | | | Not Relevant | |
| | h.8 (39) | Retrofit - Pumping distribution method | | | Investigation looked for, but did not find this issue. | |
| | h.9 (40) | Retrofit - Energy/Heat Recovery | | | Investigation looked for, but did not find this issue. | |
| | h.10 (41) | Retrofit - System (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.11 (42) | Retrofit - Efficient Lighting | | | Investigation looked for, but did not find this issue. | |
| | h.12 (43) | Retrofit - Building Envelope | | | Not cost-effective to investigate | |
| | h.13 (44) | Retrofit - Alternative Energy | | | Not Relevant | |
| | h.14 (45) | OTHER_Retrofit | | | Investigation looked for, but did not find this issue. | |
| i. Maintenance Related Problems: | i.1 (46) | Differed Maintenance from Recommended/Standard | | | Not Relevant | |
| | i.2 (47) | Impurity/Contamination | | | Not Relevant | |
| | i.3 ( ) | Leaky/Stuck Damper | | | Not Relevant | |
| | i.4 ( ) | Leaky/Stuck Valve | | | Not Relevant | |
| | i.5 (48) | OTHER_Maintenance | | | Investigation looked for, but did not find this issue. | |
| j. OTHER | j.1 (49) | OTHER | | | Investigation looked for, but did not find this issue. | |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11602 - SCSU- Garvey Commons

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| a. Equipment Scheduling and Enabling: | a.1 (1) | Time of Day enabling is excessive | | | Investigation looked for, but did not find this issue. | Building is schedule in BAS and follows the building schedule well. |
| | a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | | | Investigation looked for, but did not find this issue. | Equipment is enabled when cooking starts and stuts down when cooking equipment is turned off. |
| | a.3 (3) | Lighting is on more hours than necessary. | | | Investigation looked for, but did not find this issue. | |
| | a.4 (4) | OTHER_Equipment Scheduling/Enabling | | | Investigation looked for, but did not find this issue. | |
| b. Economizer/Outside Air Loads: | b.1 (5) | Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized) | | | Investigation looked for, but did not find this issue. | |
| | b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy. | | | Not cost-effective to investigate | |
| | b.3 (7) | OTHER_Economizer/OA Loads | | | Investigation looked for, but did not find this issue. | |
| c. Controls Problems: | c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | | Investigation looked for, but did not find this issue. | |
| | c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | X | Unit Heater Penthouse | | Pnuematic tubing broken to stat used for fan cycling of steam unit heater. |
| | c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | | Investigation looked for, but did not find this issue. | |
| | c.4 (11) | OTHER_Controls | | | Investigation looked for, but did not find this issue. | |
| d. Controls (Setpoint Changes): | d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | | Investigation looked for, but did not find this issue. | |
| | d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | | Investigation looked for, but did not find this issue. | |
| | d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | |
| | d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | | Not Relevant | |
| | d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | | Investigation looked for, but did not find this issue. | |
| | d.6 (17) | Other_Controls (Setpoint Changes) | | | Investigation looked for, but did not find this issue. | |
| e. Controls (Reset Schedules): | e.1 (18) | HW Supply Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.2 (19) | CHW Supply Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.3 (20) | Supply Air Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.4 ( ) | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.5 (21) | Condenser Water Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | No condenser water. |
| | e.6 (22) | Other_Controls (Reset Schedules) | | | Investigation looked for, but did not find this issue. | |
| f. Equipment Efficiency Improvements / Load Reduction: | f.1 (23) | Daylighting Control needs optimization—Spaces are Over-Lit | | | Investigation looked for, but did not find this issue. | |
| | f.2 (24) | Pump Discharge Throttled | | | Not Relevant | |
| | f.3 (25) | Over-Pumping | | | Not Relevant | |
| | f.4 (26) | Equipment is oversized for load. | | | Investigation looked for, but did not find this issue. | |
| | f.5 (27) | OTHER_Equipment Efficiency/Load Reduction | | | Investigation looked for, but did not find this issue. | |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11602 - SCSU- Garvey Commons

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| g. Variable Frequency Drives (VFD): | g.1 (28) | VFD Retrofit - Fans | | | Not Relevant | |
| | g.2 (29) | VFD Retrofit - Pumps | | | Not Relevant | |
| | g.3 (30) | VFD Retrofit - Motors (process) | | | Not Relevant | |
| | g.4 (31) | OTHER_VFD | | | Investigation looked for, but did not find this issue. | |
| h. Retrofits: | h.1 (32) | Retrofit - Motors | | | Investigation looked for, but did not find this issue. | |
| | h.2 (33) | Retrofit - Chillers | | | Not Relevant | No chillers in this building. |
| | h.3 (34) | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | | Investigation looked for, but did not find this issue. | |
| | h.4 (35) | Retrofit - Boilers | | | Not Relevant | |
| | h.5 (36) | Retrofit - Packaged Gas fired heating | | | Investigation looked for, but did not find this issue. | |
| | h.6 (37) | Retrofit - Heat Pumps | | | Not Relevant | |
| | h.7 (38) | Retrofit - Equipment (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.8 (39) | Retrofit - Pumping distribution method | | | Not Relevant | |
| | h.9 (40) | Retrofit - Energy/Heat Recovery | | | Not Relevant | |
| | h.10 (41) | Retrofit - System (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.11 (42) | Retrofit - Efficient Lighting | X | Entire Building | | Consider 28 watt T8 replacement lamps. |
| | h.12 (43) | Retrofit - Building Envelope | | | Investigation looked for, but did not find this issue. | |
| | h.13 (44) | Retrofit - Alternative Energy | | | Investigation looked for, but did not find this issue. | |
| | h.14 (45) | OTHER_Retrofit | | | Investigation looked for, but did not find this issue. | |
| i. Maintenance Related Problems: | i.1 (46) | Differed Maintenance from Recommended/Standard | | | Investigation looked for, but did not find this issue. | |
| | i.2 (47) | Impurity/Contamination | | | Investigation looked for, but did not find this issue. | |
| | i.3 ( ) | Leaky/Stuck Damper | X | AHU-1 & AHU-2 Penthouse | | AHU-1 OA damper blade seals completely gone. AHU-2 damper blade seals partially gone. |
| | i.4 ( ) | Leaky/Stuck Valve | | | Investigation looked for, but did not find this issue. | |
| | i.5 (48) | OTHER_Maintenance | X | AHU-3 Penthouse | | Damaged steam coil, steam leak. |
| j. OTHER | j.1 (49) | OTHER | | | Investigation looked for, but did not find this issue. | |

# *Investigation Checklist*

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11603 - SCSU- Halenbeck North

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| a. Equipment Scheduling and Enabling: | a.1 (1) | Time of Day enabling is excessive | | | Not Relevant | The BAS does not enable systems in this building. |
| | a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.3 (3) | Lighting is on more hours than necessary. | | | Investigation looked for, but did not find this issue. | Most spaces have occupancy sensors |
| | a.4 (4) | OTHER_Equipment Scheduling/Enabling | | | Not Relevant | |
| b. Economizer/Outside Air Loads: | b.1 (5) | Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized) | | | Not Relevant | This building is not connected to the campus chilled water system and there is very little cooling installed. |
| | b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy. | | | Investigation looked for, but did not find this issue. | |
| | b.3 (7) | OTHER_Economizer/OA Loads | | | Investigation looked for, but did not find this issue. | |
| c. Controls Problems: | c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | | Investigation looked for, but did not find this issue. | |
| | c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | | | Investigation looked for, but did not find this issue. | |
| | c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | | Investigation looked for, but did not find this issue. | |
| | c.4 (11) | OTHER_Controls | x | Pool Unit | | OA damper is pnuematic control, upgrade to DDC to match other control points, or replace poorly operating pool unit |
| d. Controls (Setpoint Changes): | d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | | Investigation looked for, but did not find this issue. | |
| | d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | | Not Relevant | |
| | d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | | Not Relevant | constant volume systems |
| | d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | | Not Relevant | constant volume system with OA temperature reset |
| | d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | | Not Relevant | No VAV boxes in building |
| | d.6 (17) | Other_Controls (Setpoint Changes) | | | Investigation looked for, but did not find this issue. | |
| e. Controls (Reset Schedules): | e.1 (18) | HW Supply Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.2 (19) | CHW Supply Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.3 (20) | Supply Air Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | No discharge air temperature reset, dx equipment is staged to match load as well as possible |
| | e.4 ( ) | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.5 (21) | Condenser Water Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.6 (22) | Other_Controls (Reset Schedules) | | | Not Relevant | |
| f. Equipment Efficiency Improvements / Load Reduction: | f.1 (23) | Daylighting Control needs optimization—Spaces are Over-Lit | | | Investigation looked for, but did not find this issue. | |
| | f.2 (24) | Pump Discharge Throttled | | | Investigation looked for, but did not find this issue. | |
| | f.3 (25) | Over-Pumping | | | Investigation looked for, but did not find this issue. | |
| | f.4 (26) | Equipment is oversized for load. | | | Investigation looked for, but did not find this issue. | |
| | f.5 (27) | OTHER_Equipment Efficiency/Load Reduction | | | Investigation looked for, but did not find this issue. | |
| g. Variable Frequency Drives (VFD): | g.1 (28) | VFD Retrofit - Fans | | | Not Relevant | |
| | g.2 (29) | VFD Retrofit - Pumps | | | Not Relevant | System uses a HW temperature reset, based on OA temperature. Modulating flow would risk unstable operation. |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11603 - SCSU- Halenbeck North

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| g. Variable Frequency Drives (VFD): | g.3 (30) | VFD Retrofit - Motors (process) | | | Not Relevant | No process motors in this building |
| | g.4 (31) | OTHER_VFD | | | Investigation looked for, but did not find this issue. | |
| h. Retrofits: | h.1 (32) | Retrofit - Motors | | | Not cost-effective to investigate | |
| | h.2 (33) | Retrofit - Chillers | | | Not Relevant | No chillers in this building |
| | h.3 (34) | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | | Investigation looked for, but did not find this issue. | |
| | h.4 (35) | Retrofit - Boilers | | | Not Relevant | |
| | h.5 (36) | Retrofit - Packaged Gas fired heating | | | Investigation looked for, but did not find this issue. | |
| | h.6 (37) | Retrofit - Heat Pumps | | | Not Relevant | |
| | h.7 (38) | Retrofit - Equipment (custom) | | | Not Relevant | |
| | h.8 (39) | Retrofit - Pumping distribution method | | | Investigation looked for, but did not find this issue. | |
| | h.9 (40) | Retrofit - Energy/Heat Recovery | | | Not cost-effective to investigate | |
| | h.10 (41) | Retrofit - System (custom) | x | Pool Unit | | The natatorium ventilation system is not automatically controlled, the temperature and humidity are not set for optimal efficiency, and major components are inoperative. |
| | h.11 (42) | Retrofit - Efficient Lighting | x | throughout building | | switch from T-8 32 watt to 28 watt |
| | h.12 (43) | Retrofit - Building Envelope | | | Not cost-effective to investigate | Maintenance staff indicated that the roof was re-insulated to R-30. Additional insulation would not be cost effective. |
| | h.13 (44) | Retrofit - Alternative Energy | | | Not cost-effective to investigate | |
| | h.14 (45) | OTHER_Retrofit | | | Investigation looked for, but did not find this issue. | |
| i. Maintenance Related Problems: | i.1 (46) | Differed Maintenance from Recommended/Standard | | | Investigation looked for, but did not find this issue. | |
| | i.2 (47) | Impurity/Contamination | | | Investigation looked for, but did not find this issue. | |
| | i.3 ( ) | Leaky/Stuck Damper | | | Investigation looked for, but did not find this issue. | |
| | i.4 ( ) | Leaky/Stuck Valve | | | Investigation looked for, but did not find this issue. | |
| | i.5 (48) | OTHER_Maintenance | | | Investigation looked for, but did not find this issue. | |
| j. OTHER | j.1 (49) | OTHER | | | Investigation looked for, but did not find this issue. | |

# *Investigation Checklist*

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11604 - SCSU- Halenbeck South

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| a. Equipment Scheduling and Enabling: | a.1 (1) | Time of Day enabling is excessive | X | Throughout building | | Building is scheduled to be open 6AM until 11PM weekdays, 9AM-6PM Sat & noon to 11PM on Sun.<br>Unit 7 starts an hour early on weekdays.<br>AHU-9 starts 2 hours early and AHU-10 3 hours early on Sat.<br>No data on field house units (SF 1-6). |
| | a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.3 (3) | Lighting is on more hours than necessary. | X | Throughout Building | | Lighting was on in several areas that were unoccpied |
| | a.4 (4) | OTHER_Equipment Scheduling/Enabling | | | Investigation looked for, but did not find this issue. | |
| b. Economizer/Outside Air Loads: | b.1 (5) | Economizer Operation -- Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized) | X | AHU-7 | | Damper is at 10% during all occupied hours |
| | b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy. | | | Investigation looked for, but did not find this issue. | |
| | b.3 (7) | OTHER_Economizer/OA Loads | | | Not Relevant | |
| c. Controls Problems: | c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | | Not Relevant | |
| | c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | | | Investigation looked for, but did not find this issue. | |
| | c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | | Investigation looked for, but did not find this issue. | |
| | c.4 (11) | OTHER_Controls | | | Not Relevant | |
| d. Controls (Setpoint Changes): | d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | | Not Relevant | few windows and building lighting is scheduled on BAS |
| | d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | | Investigation looked for, but did not find this issue. | |
| | d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | Fieldhouse units 1-6 obseved running at reduced speed. |
| | d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | | Not Relevant | Steam heat, no chilled water in this building |
| | d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | | Not Relevant | No VAV boxes in this building |
| | d.6 (17) | Other_Controls (Setpoint Changes) | | | Investigation looked for, but did not find this issue. | |
| e. Controls (Reset Schedules): | e.1 (18) | HW Supply Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | Steam heat |
| | e.2 (19) | CHW Supply Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | No chilled water in this building |
| | e.3 (20) | Supply Air Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.4 ( ) | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | | Not Relevant | Constant volume AHUs |
| | e.5 (21) | Condenser Water Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.6 (22) | Other_Controls (Reset Schedules) | | | Investigation looked for, but did not find this issue. | |
| f. Equipment Efficiency Improvements / Load Reduction: | f.1 (23) | Daylighting Control needs optimization—Spaces are Over-Lit | | | Investigation looked for, but did not find this issue. | |
| | f.2 (24) | Pump Discharge Throttled | | | Not Relevant | No pumping systems |
| | f.3 (25) | Over-Pumping | | | Not Relevant | No pumping systems |
| | f.4 (26) | Equipment is oversized for load. | | | Investigation looked for, but did not find this issue. | |
| | f.5 (27) | OTHER_Equipment Efficiency/Load Reduction | | | Investigation looked for, but did not find this issue. | |
| | g.1 (28) | VFD Retrofit - Fans | | | Not cost-effective to investigate | Fieldhouse units are VAV and others too small to be cost effective for retrofit. |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11604 - SCSU- Halenbeck South

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| g. Variable Frequency Drives (VFD): | g.2 (29) | VFD Retrofit - Pumps | | | Not Relevant | No pumping systems |
| | g.3 (30) | VFD Retrofit - Motors (process) | | | Not Relevant | No process motors in this building |
| | g.4 (31) | OTHER_VFD | | | Investigation looked for, but did not find this issue. | |
| h. Retrofits: | h.1 (32) | Retrofit - Motors | | | Investigation looked for, but did not find this issue. | |
| | h.2 (33) | Retrofit - Chillers | | | Not Relevant | No chillers in this building |
| | h.3 (34) | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | | Not Relevant | No mechanical cooling in this building |
| | h.4 (35) | Retrofit - Boilers | | | Not Relevant | No boilers in this building |
| | h.5 (36) | Retrofit - Packaged Gas fired heating | | | Investigation looked for, but did not find this issue. | |
| | h.6 (37) | Retrofit - Heat Pumps | | | Not Relevant | |
| | h.7 (38) | Retrofit - Equipment (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.8 (39) | Retrofit - Pumping distribution method | | | Not Relevant | No pumping systems |
| | h.9 (40) | Retrofit - Energy/Heat Recovery | | | Not Relevant | |
| | h.10 (41) | Retrofit - System (custom) | | | Not Relevant | |
| | h.11 (42) | Retrofit - Efficient Lighting | X | Throughout Building | | Consider 28 watt T8 replacement lamps |
| | h.12 (43) | Retrofit - Building Envelope | | | Not cost-effective to investigate | |
| | h.13 (44) | Retrofit - Alternative Energy | | | Investigation looked for, but did not find this issue. | |
| | h.14 (45) | OTHER_Retrofit | | | Investigation looked for, but did not find this issue. | |
| i. Maintenance Related Problems: | i.1 (46) | Differed Maintenance from Recommended/Standard | | | Investigation looked for, but did not find this issue. | |
| | i.2 (47) | Impurity/Contamination | | | Investigation looked for, but did not find this issue. | |
| | i.3 ( ) | Leaky/Stuck Damper | X | | | MAT on AHU-9 & 10 very low at night. |
| | i.4 ( ) | Leaky/Stuck Valve | | | Investigation looked for, but did not find this issue. | |
| | i.5 (48) | OTHER_Maintenance | | | Investigation looked for, but did not find this issue. | |
| j. OTHER | j.1 (49) | OTHER | | | Investigation looked for, but did not find this issue. | |

# *Investigation Checklist*

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11605 - SCSU- Heating and Maintenance

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| a. Equipment Scheduling and Enabling: | a.1 (1) | Time of Day enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.3 (3) | Lighting is on more hours than necessary. | | | Investigation looked for, but did not find this issue. | |
| | a.4 (4) | OTHER Equipment Scheduling/Enabling | | | Investigation looked for, but did not find this issue. | |
| b. Economizer/Outside Air Loads: | b.1 (5) | Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized) | | | Not Relevant | No AHUs in this building |
| | b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy. | | | Not Relevant | No AHUs in this building |
| | b.3 (7) | OTHER Economizer/OA Loads | | | Not Relevant | No AHUs in this building |
| c. Controls Problems: | c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | | Not Relevant | No AHUs in this building |
| | c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | | | Investigation looked for, but did not find this issue. | |
| | c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | | Investigation looked for, but did not find this issue. | |
| | c.4 (11) | OTHER_Controls | | | Investigation looked for, but did not find this issue. | |
| d. Controls (Setpoint Changes): | d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | | Investigation looked for, but did not find this issue. | |
| | d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | | Investigation looked for, but did not find this issue. | |
| | d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | |
| | d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | |
| | d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | | Not Relevant | No VAV boxes |
| | d.6 (17) | Other Controls (Setpoint Changes) | | | Investigation looked for, but did not find this issue. | |
| e. Controls (Reset Schedules): | e.1 (18) | HW Supply Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | No AHUs or active radiation using heating water in building |
| | e.2 (19) | CHW Supply Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | No CHW cooling in building |
| | e.3 (20) | Supply Air Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | No AHUs in building |
| | e.4 ( ) | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.5 (21) | Condenser Water Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.6 (22) | Other_Controls (Reset Schedules) | | | Investigation looked for, but did not find this issue. | |
| f. Equipment Efficiency Improvements / Load Reduction: | f.1 (23) | Daylighting Control needs optimization—Spaces are Over-Lit | | | Investigation looked for, but did not find this issue. | |
| | f.2 (24) | Pump Discharge Throttled | | | Investigation looked for, but did not find this issue. | |
| | f.3 (25) | Over-Pumping | | | Investigation looked for, but did not find this issue. | |
| | f.4 (26) | Equipment is oversized for load. | | | Investigation looked for, but did not find this issue. | |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11605 - SCSU- Heating and Maintenance

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| | f.5 (27) | OTHER_Equipment Efficiency/Load Reduction | | | Investigation looked for, but did not find this issue. | |
| g. Variable Frequency Drives (VFD): | g.1 (28) | VFD Retrofit - Fans | | | Not Relevant | |
| | g.2 (29) | VFD Retrofit - Pumps | | | Investigation looked for, but did not find this issue. | |
| | g.3 (30) | VFD Retrofit - Motors (process) | | | Not Relevant | No process motors in this building |
| | g.4 (31) | OTHER_VFD | | | Investigation looked for, but did not find this issue. | |
| h. Retrofits: | h.1 (32) | Retrofit - Motors | | | Investigation looked for, but did not find this issue. | |
| | h.2 (33) | Retrofit - Chillers | | | Not Relevant | No chillers in this building |
| | h.3 (34) | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | | Not Relevant | |
| | h.4 (35) | Retrofit - Boilers | | | Investigation looked for, but did not find this issue. | |
| | h.5 (36) | Retrofit - Packaged Gas fired heating | | | Investigation looked for, but did not find this issue. | |
| | h.6 (37) | Retrofit - Heat Pumps | | | Not Relevant | |
| | h.7 (38) | Retrofit - Equipment (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.8 (39) | Retrofit - Pumping distribution method | | | Not Relevant | |
| | h.9 (40) | Retrofit - Energy/Heat Recovery | x | boiler room | | heat combustion air using flue gases, feedwater economizer for boilers B-1 & B-2. Boiler blowdown heat recovery. |
| | h.10 (41) | Retrofit - System (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.11 (42) | Retrofit - Efficient Lighting | x | throughout building | | switch from T-8 32 watt to 28 watt, Also replace HID fixtures with 6 lamp T8 HO fixtures |
| | h.12 (43) | Retrofit - Building Envelope | | | Investigation looked for, but did not find this issue. | |
| | h.13 (44) | Retrofit - Alternative Energy | | | Investigation looked for, but did not find this issue. | |
| | h.14 (45) | OTHER_Retrofit | | | Not Relevant | |
| i. Maintenance Related Problems: | i.1 (46) | Differed Maintenance from Recommended/Standard | | | Investigation looked for, but did not find this issue. | |
| | i.2 (47) | Impurity/Contamination | | | Investigation looked for, but did not find this issue. | |
| | i.3 ( ) | Leaky/Stuck Damper | | | Investigation looked for, but did not find this issue. | |
| | i.4 ( ) | Leaky/Stuck Valve | | | Investigation looked for, but did not find this issue. | |
| | i.5 (48) | OTHER Maintenance | x | entire building | | Several lineal feet of uninsulated steam and condensate piping identified |
| j. OTHER | j.1 (49) | OTHER | | | Investigation looked for, but did not find this issue. | |

# *Investigation Checklist*

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11606 - SCSU- James Miller LRC

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| a. Equipment Scheduling and Enabling: | a.1 (1) | Time of Day enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | X | AHU-1,2,3,4 | | The posted school year opening time for this building is 7:30 AM Monday through Friday, 10:00 AM on Saturday and 11:00 AM on Sunday. The building closes at 2:00 AM Sunday through Thursday, 7:00 PM Friday and 8:00 PM on Saturday. The building is open 110.5 hours per week and closed for 57.5. A computer lab on the first floor is open 24/7.<br><br>The AHUs 1 & 2 are run 24/7, but at a reduced SA static pressure over night. AHU-5 serves a 24/7 computer lab and runs continuously. AHU-6 serves a theater and operates approximately 60 hours per week. AHU-7 & 8 are Liebert computer room units where one unit operates continuously and the other provides back-up service. AHU-9 has an enery recovery wheel and runs continuously. |
| | a.3 (3) | Lighting is on more hours than necessary. | X | Throughout Building | | Lighting was on in several areas that were unoccpied |
| | a.4 (4) | OTHER Equipment Scheduling/Enabling | | | Not Relevant | |
| b. Economizer/Outside Air Loads: | b.1 (5) | Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized) | | | Investigation looked for, but did not find this issue. | |
| | b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy. | | | Investigation looked for, but did not find this issue. | |
| | b.3 (7) | OTHER_Economizer/OA Loads | | | Investigation looked for, but did not find this issue. | |
| c. Controls Problems: | c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | | Investigation looked for, but did not find this issue. | |
| | c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | | | Investigation looked for, but did not find this issue. | |
| | c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | | Investigation looked for, but did not find this issue. | |
| | c.4 (11) | OTHER Controls | | | Investigation looked for, but did not find this issue. | |
| d. Controls (Setpoint Changes): | d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | | Investigation looked for, but did not find this issue. | |
| | d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | | Investigation looked for, but did not find this issue. | |
| | d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | |
| | d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | |
| | d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | | Investigation looked for, but did not find this issue. | VAV min flow rates OK, but increased flow on some would reduce reheat on others. |
| | d.6 (17) | Other_Controls (Setpoint Changes) | | | Investigation looked for, but did not find this issue. | |
| e. Controls (Reset Schedules): | e.1 (18) | HW Supply Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.2 (19) | CHW Supply Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.3 (20) | Supply Air Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.4 ( ) | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | Static pressure is not set higher than 2" and this is not excessive. |
| | e.5 (21) | Condenser Water Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | no water cooled condenser |
| | e.6 (22) | Other_Controls (Reset Schedules) | | | Investigation looked for, but did not find this issue. | |
| | f.1 (23) | Daylighting Control needs optimization—Spaces are Over-Lit | | | Investigation looked for, but did not find this issue. | |
| | f.2 (24) | Pump Discharge Throttled | | | Investigation looked for, but did not find this issue. | |

# *Investigation Checklist*

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11606 - SCSU- James Miller LRC

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| f. Equipment Efficiency Improvements / Load Reduction: | f.3 (25) | Over-Pumping | | | Investigation looked for, but did not find this issue. | |
| | f.4 (26) | Equipment is oversized for load. | | | Not cost-effective to investigate | Equipment can modulate to efficiently handle partial loading. |
| | f.5 (27) | OTHER_Equipment Efficiency/Load Reduction | | | Investigation looked for, but did not find this issue. | |
| g. Variable Frequency Drives (VFD): | g.1 (28) | VFD Retrofit - Fans | | | Not Relevant | All fans with variable loads have VFDs |
| | g.2 (29) | VFD Retrofit - Pumps | | | Not cost-effective to investigate | |
| | g.3 (30) | VFD Retrofit - Motors (process) | | | Not Relevant | No process |
| | g.4 (31) | OTHER_VFD | | | Not Relevant | |
| h. Retrofits: | h.1 (32) | Retrofit - Motors | | | Not Relevant | Most motors are premium efficiency |
| | h.2 (33) | Retrofit - Chillers | | | Not Relevant | No chillers in building |
| | h.3 (34) | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | | Investigation looked for, but did not find this issue. | |
| | h.4 (35) | Retrofit - Boilers | | | Not Relevant | No boilers |
| | h.5 (36) | Retrofit - Packaged Gas fired heating | | | Not Relevant | No gas heating equipment |
| | h.6 (37) | Retrofit - Heat Pumps | | | Not Relevant | None |
| | h.7 (38) | Retrofit - Equipment (custom) | | | Not Relevant | |
| | h.8 (39) | Retrofit - Pumping distribution method | | | Not cost-effective to investigate | |
| | h.9 (40) | Retrofit - Energy/Heat Recovery | | | Not cost-effective to investigate | Decentralized exhaust and ventilation reduction options make this a weak candidate for implementaion. |
| | h.10 (41) | Retrofit - System (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.11 (42) | Retrofit - Efficient Lighting | X | Throughout Building | | Consider 28 watt T8 replacement lamps |
| | h.12 (43) | Retrofit - Building Envelope | | | Not cost-effective to investigate | |
| | h.13 (44) | Retrofit - Alternative Energy | | | Not cost-effective to investigate | |
| | h.14 (45) | OTHER_Retrofit | | | Investigation looked for, but did not find this issue. | |
| i. Maintenance Related Problems: | i.1 (46) | Differed Maintenance from Recommended/Standard | | | Investigation looked for, but did not find this issue. | |
| | i.2 (47) | Impurity/Contamination | | | Investigation looked for, but did not find this issue. | |
| | i.3 ( ) | Leaky/Stuck Damper | | | Investigation looked for, but did not find this issue. | |
| | i.4 ( ) | Leaky/Stuck Valve | | | Investigation looked for, but did not find this issue. | |
| | i.5 (48) | OTHER_Maintenance | | | Investigation looked for, but did not find this issue. | |
| j. OTHER | j.1 (49) | OTHER | | | Investigation looked for, but did not find this issue. | |

# *Investigation Checklist*

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11607 - SCSU- Mitchell Hall

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| a. Equipment Scheduling and Enabling: | a.1 (1) | Time of Day enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.3 (3) | Lighting is on more hours than necessary. | | | Investigation looked for, but did not find this issue. | |
| | a.4 (4) | OTHER Equipment Scheduling/Enabling | | | Investigation looked for, but did not find this issue. | |
| b. Economizer/Outside Air Loads: | b.1 (5) | Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized) | | | Investigation looked for, but did not find this issue. | |
| | b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy. | | | Investigation looked for, but did not find this issue. | |
| | b.3 (7) | OTHER Economizer/OA Loads | | | Investigation looked for, but did not find this issue. | |
| c. Controls Problems: | c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | | Investigation looked for, but did not find this issue. | |
| | c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | | | Investigation looked for, but did not find this issue. | |
| | c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | | Investigation looked for, but did not find this issue. | |
| | c.4 (11) | OTHER_Controls | | | Investigation looked for, but did not find this issue. | |
| d. Controls (Setpoint Changes): | d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | | Investigation looked for, but did not find this issue. | |
| | d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | | Investigation looked for, but did not find this issue. | |
| | d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | | Not Relevant | |
| | d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | | Not Relevant | |
| | d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | | Investigation looked for, but did not find this issue. | |
| | d.6 (17) | Other Controls (Setpoint Changes) | | | Investigation looked for, but did not find this issue. | |
| e. Controls (Reset Schedules): | e.1 (18) | HW Supply Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | Currently in place and operating well |
| | e.2 (19) | CHW Supply Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.3 (20) | Supply Air Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | Discharge are is currently varied from 60 - 80 degrees F based on average space temperature. |
| | e.4 ( ) | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.5 (21) | Condenser Water Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.6 (22) | Other_Controls (Reset Schedules) | | | Investigation looked for, but did not find this issue. | |
| f. Equipment Efficiency Improvements / Load Reduction: | f.1 (23) | Daylighting Control needs optimization—Spaces are Over-Lit | | | Investigation looked for, but did not find this issue. | |
| | f.2 (24) | Pump Discharge Throttled | | | Investigation looked for, but did not find this issue. | |
| | f.3 (25) | Over-Pumping | | | Investigation looked for, but did not find this issue. | |
| | f.4 (26) | Equipment is oversized for load. | | | Investigation looked for, but did not find this issue. | |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11607 - SCSU- Mitchell Hall

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| | f.5 (27) | OTHER_Equipment Efficiency/Load Reduction | | | Not Relevant | |
| g. Variable Frequency Drives (VFD): | g.1 (28) | VFD Retrofit - Fans | | | Investigation looked for, but did not find this issue. | |
| | g.2 (29) | VFD Retrofit - Pumps | | | Investigation looked for, but did not find this issue. | Outside air temperature reset in place |
| | g.3 (30) | VFD Retrofit - Motors (process) | | | Not Relevant | |
| | g.4 (31) | OTHER_VFD | | | Not Relevant | |
| h. Retrofits: | h.1 (32) | Retrofit - Motors | | | Investigation looked for, but did not find this issue. | |
| | h.2 (33) | Retrofit - Chillers | | | Not Relevant | |
| | h.3 (34) | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | | Not Relevant | |
| | h.4 (35) | Retrofit - Boilers | | | Not Relevant | |
| | h.5 (36) | Retrofit - Packaged Gas fired heating | | | Not Relevant | |
| | h.6 (37) | Retrofit - Heat Pumps | | | Not Relevant | |
| | h.7 (38) | Retrofit - Equipment (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.8 (39) | Retrofit - Pumping distribution method | | | Not Relevant | |
| | h.9 (40) | Retrofit - Energy/Heat Recovery | | | Not cost-effective to investigate | |
| | h.10 (41) | Retrofit - System (custom) | | | Not Relevant | |
| | h.11 (42) | Retrofit - Efficient Lighting | x | Throughout Building | | 28 watt T8 replacement lamps |
| | h.12 (43) | Retrofit - Building Envelope | | | Not cost-effective to investigate | |
| | h.13 (44) | Retrofit - Alternative Energy | | | Not cost-effective to investigate | |
| | h.14 (45) | OTHER_Retrofit | | | Investigation looked for, but did not find this issue. | |
| i. Maintenance Related Problems: | i.1 (46) | Differed Maintenance from Recommended/Standard | | | Investigation looked for, but did not find this issue. | |
| | i.2 (47) | Impurity/Contamination | | | Investigation looked for, but did not find this issue. | |
| | i.3 ( ) | Leaky/Stuck Damper | | | Investigation looked for, but did not find this issue. | Verified via functional test at AHU. Dampers seal tight. |
| | i.4 ( ) | Leaky/Stuck Valve | | | Investigation looked for, but did not find this issue. | Verified proper opertion at the unit and via trend data |
| | i.5 (48) | OTHER Maintenance | | | Investigation looked for, but did not find this issue. | |
| j. OTHER | j.1 (49) | OTHER | | | Investigation looked for, but did not find this issue. | |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11608 - SCSU- National Hockey Center

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| a. Equipment Scheduling and Enabling: | a.1 (1) | Time of Day enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.3 (3) | Lighting is on more hours than necessary. | x | Throughout Building | | Lighting was on in several areas that were unoccpied. |
| | a.4 (4) | OTHER_Equipment Scheduling/Enabling | | | Investigation looked for, but did not find this issue. | |
| b. Economizer/Outside Air Loads: | b.1 (5) | Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized) | | | Investigation looked for, but did not find this issue. | |
| | b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy. | | | Investigation looked for, but did not find this issue. | |
| | b.3 (7) | OTHER_Economizer/OA Loads | X | Desiccant unit 2 | | Desiccant unit 2 is overused during cold weather. |
| c. Controls Problems: | c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | | Investigation looked for, but did not find this issue. | |
| | c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | | | Investigation looked for, but did not find this issue. | |
| | c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | | Investigation looked for, but did not find this issue. | |
| | c.4 (11) | OTHER_Controls | | | Investigation looked for, but did not find this issue. | |
| d. Controls (Setpoint Changes): | d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | | Investigation looked for, but did not find this issue. | |
| | d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | | Investigation looked for, but did not find this issue. | |
| | d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | |
| | d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | |
| | d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | | Not Relevant | No VAVs in this building. |
| | d.6 (17) | Other_Controls (Setpoint Changes) | | | Investigation looked for, but did not find this issue. | |
| e. Controls (Reset Schedules): | e.1 (18) | HW Supply Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.2 (19) | CHW Supply Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | No chilled water in this building. |
| | e.3 (20) | Supply Air Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.4 ( ) | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.5 (21) | Condenser Water Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.6 (22) | Other_Controls (Reset Schedules) | | | Investigation looked for, but did not find this issue. | |
| f. Equipment Efficiency Improvements / Load Reduction: | f.1 (23) | Daylighting Control needs optimization—Spaces are Over-Lit | | | Investigation looked for, but did not find this issue. | |
| | f.2 (24) | Pump Discharge Throttled | | | Investigation looked for, but did not find this issue. | |
| | f.3 (25) | Over-Pumping | | | Investigation looked for, but did not find this issue. | |
| | f.4 (26) | Equipment is oversized for load. | | | | Large dehumidifing unit rarely runs. |
| | f.5 (27) | OTHER_Equipment Efficiency/Load Reduction | | | Investigation looked for, but did not find this issue. | |
| | g.1 (28) | VFD Retrofit - Fans | | | Investigation looked for, but did not find this issue. | |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11608 - SCSU- National Hockey Center

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| g. Variable Frequency Drives (VFD): | g.2 (29) | VFD Retrofit - Pumps | | | Investigation looked for, but did not find this issue. | |
| | g.3 (30) | VFD Retrofit - Motors (process) | | | Not Relevant | No process motors in this building. |
| | g.4 (31) | OTHER_VFD | | | Investigation looked for, but did not find this issue. | |
| h. Retrofits: | h.1 (32) | Retrofit - Motors | | | Investigation looked for, but did not find this issue. | Newer building with new high efficiency motors. |
| | h.2 (33) | Retrofit - Chillers | | | Not Relevant | |
| | h.3 (34) | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | | Investigation looked for, but did not find this issue. | |
| | h.4 (35) | Retrofit - Boilers | | | Not cost-effective to investigate | Existing boiler is condensing boiler. |
| | h.5 (36) | Retrofit - Packaged Gas fired heating | | | Investigation looked for, but did not find this issue. | |
| | h.6 (37) | Retrofit - Heat Pumps | | | Not Relevant | |
| | h.7 (38) | Retrofit - Equipment (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.8 (39) | Retrofit - Pumping distribution method | | | Investigation looked for, but did not find this issue. | |
| | h.9 (40) | Retrofit - Energy/Heat Recovery | | | Investigation looked for, but did not find this issue. | |
| | h.10 (41) | Retrofit - System (custom) | | | Investigation looked for, but did not find this issue. | |
| | h.11 (42) | Retrofit - Efficient Lighting | x | Throughout Building | | Consider 28 watt T8 replacement lamps, consider replacing HID fixtures with HO T8 fixtures |
| | h.12 (43) | Retrofit - Building Envelope | | | Investigation looked for, but did not find this issue. | |
| | h.13 (44) | Retrofit - Alternative Energy | | | | |
| | h.14 (45) | OTHER_Retrofit | | | Investigation looked for, but did not find this issue. | |
| i. Maintenance Related Problems: | i.1 (46) | Differed Maintenance from Recommended/Standard | | | Investigation looked for, but did not find this issue. | |
| | i.2 (47) | Impurity/Contamination | | | Investigation looked for, but did not find this issue. | |
| | i.3 ( ) | Leaky/Stuck Damper | | | Investigation looked for, but did not find this issue. | |
| | i.4 ( ) | Leaky/Stuck Valve | | | Investigation looked for, but did not find this issue. | |
| | i.5 (48) | OTHER_Maintenance | | | Investigation looked for, but did not find this issue. | |
| j. OTHER | j.1 (49) | OTHER | | | Investigation looked for, but did not find this issue. | |

# *Investigation Checklist*

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11609 - SCSU- Rec Facility/Stadium

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| a. Equipment Scheduling and Enabling: | a.1 (1) | Time of Day enabling is excessive | X | AHU2 | | Excessive Enabling of AHU2. |
| | a.2 (2) | Equipment is enabled regardless of need, or such enabling is excessive | | | Investigation looked for, but did not find this issue. | |
| | a.3 (3) | Lighting is on more hours than necessary. | | | Investigation looked for, but did not find this issue. | |
| | a.4 (4) | OTHER_Equipment Scheduling/Enabling | | | Not Relevant | |
| b. Economizer/Outside Air Loads: | b.1 (5) | Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized) | | | Investigation looked for, but did not find this issue. | |
| | b.2 (6) | Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy. | | | Investigation looked for, but did not find this issue. | |
| | b.3 (7) | OTHER_Economizer/OA Loads | | | Investigation looked for, but did not find this issue. | |
| c. Controls Problems: | c.1 (8) | Simultaneous Heating and Cooling is present and excessive | | | Investigation looked for, but did not find this issue. | |
| | c.2 (9) | Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement | | | Investigation looked for, but did not find this issue. | |
| | c.3 (10) | Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints | | | Investigation looked for, but did not find this issue. | |
| | c.4 (11) | OTHER_Controls | | | Not Relevant | |
| d. Controls (Setpoint Changes): | d.1 (12) | Daylighting controls or occupancy sensors need optimization. | | | Investigation looked for, but did not find this issue. | |
| | d.2 (13) | Zone setpoint setup/setback are not implemented or are sub-optimal. | | | Investigation looked for, but did not find this issue. | |
| | d.3 (14) | Fan Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | AHU-1 & 2 are VAV systems |
| | d.4 (15) | Pump Speed Doesn't Vary Sufficiently | | | Investigation looked for, but did not find this issue. | System operates on constant pressure differential pumping and variable water temperature. Varying two variables would likely cause system instability. |
| | d.5 (16) | VAV Box Minimum Flow Setpoint is higher than necessary | | | Investigation looked for, but did not find this issue. | |
| | d.6 (17) | Other_Controls (Setpoint Changes) | | | Investigation looked for, but did not find this issue. | AHU mixed air and supply air temperature set point trends were studied and no significant issues were observed, based on winter operating conditions. |
| e. Controls (Reset Schedules): | e.1 (18) | HW Supply Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | Water temperature is reset. |
| | e.2 (19) | CHW Supply Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.3 (20) | Supply Air Temperature Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.4 ( ) | Supply Duct Static Pressure Reset is not implemented or is sub-optimal | | | Investigation looked for, but did not find this issue. | |
| | e.5 (21) | Condenser Water Temperature Reset is not implemented or is sub-optimal | | | Not Relevant | |
| | e.6 (22) | Other_Controls (Reset Schedules) | | | Investigation looked for, but did not find this issue. | |
| | f.1 (23) | Daylighting Control needs optimization—Spaces are Over-Lit | | | Investigation looked for, but did not find this issue. | |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11609 - SCSU- Rec Facility/Stadium

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| f. Equipment Efficiency Improvements / Load Reduction: | f.2 (24) | Pump Discharge Throttled | | | Investigation looked for, but did not find this issue. | Flow is balanced with VFD's water temperature is reset by OA temperature. |
| | f.3 (25) | Over-Pumping | | | Investigation looked for, but did not find this issue. | |
| | f.4 (26) | Equipment is oversized for load. | | | Not cost-effective to investigate | |
| | f.5 (27) | OTHER_Equipment Efficiency/Load Reduction | | | Investigation looked for, but did not find this issue. | |
| g. Variable Frequency Drives (VFD): | g.1 (28) | VFD Retrofit - Fans | | | Investigation looked for, but did not find this issue. | AHU fans have VFDs |
| | g.2 (29) | VFD Retrofit - Pumps | | | Investigation looked for, but did not find this issue. | Pumps have VFDs |
| | g.3 (30) | VFD Retrofit - Motors (process) | | | Not Relevant | |
| | g.4 (31) | OTHER_VFD | | | Not Relevant | |
| h. Retrofits: | h.1 (32) | Retrofit - Motors | | | Not cost-effective to investigate | |
| | h.2 (33) | Retrofit - Chillers | | | Not Relevant | |
| | h.3 (34) | Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment) | | | Not Relevant | |
| | h.4 (35) | Retrofit - Boilers | | | Not Relevant | |
| | h.5 (36) | Retrofit - Packaged Gas fired heating | | | Not Relevant | |
| | h.6 (37) | Retrofit - Heat Pumps | | | Not Relevant | |
| | h.7 (38) | Retrofit - Equipment (custom) | | | Not Relevant | |
| | h.8 (39) | Retrofit - Pumping distribution method | | | Not Relevant | |
| | h.9 (40) | Retrofit - Energy/Heat Recovery | | | Not Relevant | Heat wheels installed. |
| | h.10 (41) | Retrofit - System (custom) | | | Not Relevant | |
| | h.11 (42) | Retrofit - Efficient Lighting | X | Throughout Building | | Consider 28 watt T8 replacement lamps, consider replacing HID fixtures with HO T8 fixtures |
| | h.12 (43) | Retrofit - Building Envelope | | | Not cost-effective to investigate | |
| | h.13 (44) | Retrofit - Alternative Energy | | | Not cost-effective to investigate | |
| | h.14 (45) | OTHER_Retrofit | | | Investigation looked for, but did not find this issue. | |
| i. Maintenance Related Problems: | i.1 (46) | Differed Maintenance from Recommended/Standard | | | Investigation looked for, but did not find this issue. | |
| | i.2 (47) | Impurity/Contamination | | | Investigation looked for, but did not find this issue. | |
| | i.3 ( ) | Leaky/Stuck Damper | | | Investigation looked for, but did not find this issue. | |
| | i.4 ( ) | Leaky/Stuck Valve | | | Investigation looked for, but did not find this issue. | |
| | i.5 (48) | OTHER_Maintenance | | | Not Relevant | |

PBEEEP State Government

Rev. 2.0 (12/16/2010)

## 11609 - SCSU- Rec Facility/Stadium

**This checklist is designed to be a resource and reference for Providers and PBEEEP.**

| Finding Category | Finding Type Number | Finding Type | Relevant Findings (if any) | Finding Location | Reason for no relevant finding | Notes |
|---|---|---|---|---|---|---|
| j. OTHER | **j.1 (49)** | OTHER | | | Not Relevant | |

414 Nicollet Mall, GO-6
Minneapolis, MN 55401

1-800-481-4700
xcelenergy.com

February 28, 2011

**SCSU**
**Attn: John Frischmann**
**720 4th Ave. S.**
**St. Cloud, MN 56301**

Dear John:

Thank you for participating in Xcel Energy's Recommissioning program. We have reviewed your study applications and proposals and have preapproved your studies. The following outlines your rebates and project information:

| | | | |
|---|---|---|---|
| Building Address | **Chilled Water Plant** | | |
| Study Cost | $1,131.00 | Study Number | RM1554.1 |
| **Preapproved study rebate*** | **$825.00** | | |
| * Your rebate was based on the study cost provided. If the final study cost is lower, your rebate will be adjusted accordingly. | | | |
| Study Provider | **AMEC** | | |
| Account manager | **Scott Hinde** Phone **320-269-7862** | | |

| | | | |
|---|---|---|---|
| Building Address | **Garvey Commons** | | |
| Study Cost | $7,597.00 | Study Number | RM1554.2 |
| **Preapproved study rebate*** | **$5,675.00** | | |

| | | | |
|---|---|---|---|
| Building Address | **Hallenbeck North** | | |
| Study Cost | $19,709.00 | Study Number | RM1554.3 |
| **Preapproved study rebate*** | **$14,775.00** | | |

| | | | |
|---|---|---|---|
| Building Address | **Hallenbeck South** | | |
| Study Cost | $14,900.00 | Study Number | RM1554.4 |
| **Preapproved study rebate*** | **$11,175.00** | | |

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1-800-481-4700
xcelenergy.com

| Building Address | **Heating and Maintenance 1** | | |
|---|---|---|---|
| Study Cost | $2,815.00 | Study Number | RM1554.5 |
| **Preapproved study rebate*** | **$2,100.00** | | |

| Building Address | **Learning Resource Center** | | |
|---|---|---|---|
| Study Cost | $35,015.00 | Study Number | RM1554.6 |
| **Preapproved study rebate*** | **$25,000.00** | | |

| Building Address | **Mitchell Hall** | | |
|---|---|---|---|
| Study Cost | $16,358.00 | Study Number | RM1554.7 |
| **Preapproved study rebate*** | **$12,250.00** | | |

| Building Address | **National Hockey Center** | | |
|---|---|---|---|
| Study Cost | $22,656.00 | Study Number | RM1554.8 |
| **Preapproved study rebate*** | **$16,975.00** | | |

| Building Address | **Recreational Facility** | | |
|---|---|---|---|
| Study Cost | $5,960.00 | Study Number | RM1554.9 |
| **Preapproved study rebate*** | **$4,450.00** | | |

| Building Address | **Stadium** | | |
|---|---|---|---|
| Study Cost | $5,215.00 | Study Number | RM1554.10 |
| **Preapproved study rebate*** | **$3,900.00** | | |

Here's a quick review of the Recommissioning program process:

- Once your studies are complete, your study provider will send a draft copy to us for review.
- After we complete our review and approve the studies, we will send you a confirmation letter noting our approval.
- Your study provider will schedule a wrap-up meeting with you and your Xcel Energy account manager to go over the results of the studies.
- You pay the study provider for the full cost of the studies.

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Minneapolis, MN 55401

1-800-481-4700
xcelenergy.com

- You submit the Recommissioning Study Rebate Application, along with a copy of the invoice and your Customer Implementation Plan, to us within 3 months of your report presentation. Please work with your account manager to complete the Customer Implementation Plan.
- We'll send your study rebate check to you.

**Please note that we need to approve the final study in order to receive your study rebate**.

This study pre-approval is valid for **three months** from the date of this letter. If your studies will take longer than that, please let us know. If you have any questions or comments, please call your assigned Xcel Energy account manager. Thanks again for participating in our Recommissioning program.

Sincerely,

Jon Packer
Marketing Assistant, Recommissioning

Enclosure

CC: Scott Hinde - Xcel Energy
Sherryl Volkert - Xcel Energy
Randy Richgruber - AMEC

# Deleted Findings Summary

## Site: St Cloud SU

| Eco # | Building | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|---|
| 1 | Central Chilled Water Plant | Low ΔT and the system had difficulty meeting set points during hot weather. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 2 | Garvey Commons | Over ventilation AHU-3. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 3 | Garvey Commons | Retrofit make-up air unit (AHU-3). | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 7 | Garvey Commons | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 1 | Halenbeck Hall North | The natatorium ventilation system is not automatically controlled, the temperature and humidity are | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 2 | Halenbeck Hall South | Economizer operation. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 3 | Halenbeck Hall South | No mixed air reset. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 2 | Heating and Maintenance | Feedwater economizer. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 3 | Heating and Maintenance | Boiler blow down. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 6 | Heating and Maintenance | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 8 | Heating and Maintenance | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 3 | Husky Stadium | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 5 | Husky Stadium | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 4 | James W. Miller LRC | Over ventilation. AHU-1 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 5 | James W. Miller LRC | Over ventilation. AHU-1 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 7 | James W. Miller LRC | Over ventilation. AHU-2 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 9 | James W. Miller LRC | Leaky Damper. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 10 | James W. Miller LRC | Over ventilation. AHU-3 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |

# Deleted Findings Summary

## Site: St Cloud SU

| Eco # | Building | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|---|
| 12 | James W. Miller LRC | Over ventilation. AHU-4 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 13 | James W. Miller LRC | Over ventilation. AHU-5 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 14 | James W. Miller LRC | HX failure. AHU-9 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 1 | Mitchell Hall | Over ventilation AHU-1. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 4 | Mitchell Hall | Limited Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| | | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | | **Total for all Findings:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |

# Deleted Findings Summary

## Building: Central Chilled Water Plant

## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 1 | Low ΔT and the system had difficulty meeting set points during hot weather. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |



PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: Central Chilled Water Plant

| | | | |
|---|---|---|---|
| FWB Number: | 11601 | Eco Number: | 1 |
| Site: | St Cloud SU | Date/Time Created: | 1/20/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Low ΔT and the system had difficulty meeting set points during hot weather. | Date Identified: | 9/13/2011 |
| Description of Finding: | During the hottest days of July 2011, the chilled water plant had difficulty maintaining CHS at the setpoint. Design CHS was 44 but system is set for 40. Condenser water leaving the tower exceeded design (85º F) for 49 hours. Weather conditions exceeded the design criteria, condenser water temperature exceeded condenser requirements limiting the chiller performance. Chillers failed to meet design CHS temp for 29 hours. System operates at an 8 to 9º F ΔT. | | |
| Equipment or System(s): | Chiller Plant | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | This will reduce the chilled water pump and overall system power consumption. Excessive pumping transfers heat to the water and adds load to the chiller and tower. |
| Baseline Documentation Method: | Trend data indicates that the loop ΔT is usually operated between 8 and 9º F. The chiller manufacturer's representative indicated that it was designed for a ΔT of 12º F. | | |
| Measure: | Increase the main loop ΔT to 12º F and reduce the chilled water flow rate. Since a significant portion of the campus chilled water system is beyond the scope of this project, we are unable to determine if this measure is viable. Some buildings have tertiary pumps that may or may not be operating, while other buildings do not have them. | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Summary

## Building: Garvey Commons
## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 2 | Over ventilation AHU-3. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 3 | Retrofit make-up air unit (AHU-3). | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 7 | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: Garvey Commons

| | | | |
|---|---|---|---|
| FWB Number: | 11602 | Eco Number: | 2 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over ventilation AHU-3. | Date Identified: | 2/18/2011 |
| Description of Finding: | OA damper failed on open position when freeze stat tripped. This is a maintenance issue for the purpose of asset protection, to avoid coil damage via freezing and coil rupture. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Controls contractor | Benefits: | Coil Freeze Protection. There is no verifiable energy savings associated with this measure. |
| Baseline Documentation Method: | Visual inspection and trending | | |
| Measure: | Change control sequence to close OA damper anytime unit is not in operation. Total cost of $656 contractor, $98 PBEEEP provider | | |
| Recommendation for Implementation: | Modify controls sequence to have OA damper close on freeze stat trip. | | |
| Evidence of Implementation Method: | Trending and functional test | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: Garvey Commons

| | | | |
|---|---|---|---|
| FWB Number: | 11602 | Eco Number: | 3 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Retrofit make-up air unit (AHU-3). | Date Identified: | 2/16/2011 |
| Description of Finding: | The existing kitchen make-up air unit (AHU-3) uses campus steam for heat when a direct fired gas system would be more efficient and reduce operating cost. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by PBEEEP | | |

| | | | |
|---|---|---|---|
| Implementer: | Mechanical contractor | Benefits: | Energy savings |
| Baseline Documentation Method: | Visual inspection and trending | | |
| Measure: | Provide new direct fired gas make-up air unit with a chilled water coil. 4,096 Th saved with a cost of $65,129 cotnractor and $9,769 provider; 25 year payback | | |
| Recommendation for Implementation: | Install a direct fired gas make-up air unit, with a chilled water cooling coil, to replace the existing steam heat for make-up air. | | |
| Evidence of Implementation Method: | Physical inspection and trending of air flow and discharge air temperature | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: Garvey Commons

| | | | |
|---|---|---|---|
| FWB Number: | 11602 | Eco Number: | 7 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | No Lighting Controls. | Date Identified: | 2/18/2011 |
| Description of Finding: | No lighting controls were found and lights were on in several areas when they were unoccupied. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by PBEEEP | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of rooms indicates occupancy sensors are not being utilized. | | |
| Measure: | Install Occupancy Sensors. Savings of 5,900 kWh, cost of $7,725 contractor and $1,159 provider for a payback of 26 years | | |
| Recommendation for Implementation: | Install 25 Occupancy Sensors throughout the building to control lighting. It is recommended to use a 20 min time delay for these sensors. However, if a shorter time delay is used, this will result in more energy savings. | | |
| Evidence of Implementation Method: | Visually inspect the building to ensure occupancy sensors are installed in appropriate locations. Use Light Loggers in a sample area to determine whether lights actually do turn off according to space needs. | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Summary

## Building: Halenbeck Hall North
## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 1 | The natatorium ventilation system is not automatically controlled, the temperature and humidity are | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

PBEEEP State Government

## Building: Halenbeck Hall North

| | | | |
|---|---|---|---|
| FWB Number: | 11603 | Eco Number: | 1 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | The natatorium ventilation system is not automatically controlled, the temperature and humidity are | Date Identified: | 3/9/2011 |
| Description of Finding: | The natatorium temperature was found set for, and maintained at, 76º F. The space humidity was uncontrolled and observed to be 40% RH. The pool water temperature is maintained at 80 and 83º F for the main and diving pools, respectively. The OA damper was adjusted manually, without a specific strategy or schedule. The pool unit was originally designed to maintain natatorium humidity levels with up to 19,000 CFM of outside air and heat. A 13,000 CFM Dectron dehumidificaion, air conditioning and heat recovery system is currently installed, but has has multiple maintenance, design and control issues. The maintenace issues include a failed compressor and a second refrigeration circuit that has lost all of its refrigerant through leaks. A water pump, that is supected of of tranfering heat from air stream to the pool water, is no longer installed. At some point, the OA duct was downsized from a 54" round duct to a 24" x 26", thus reducing the maximum OA flow from at least 19,000 CFM to about 5,000 CFM and severely limiting the systems ability to control humidity with ventilation. The maintenance staff indicated that there have been control malfunctions since installation of the Dectron, there is no OA damper actuator and the second generation controls, currently in place, are poorly defined and missing hardware components. Per ASHRAE, natatoriums should be maintained at 2º F above the water temperature (not to exceed 85) and the humidity between 40 and 60%, but low enough to avoild condensation on the walls. ASHRAE 62.1-2004, as incorporated by reference into the Minnesota Building code, requires 3,888 CFM of OA, based on the area of the pool and deck. A TAB contractor measured the pre-existing OA flow at 3751 CFM. If a new system cannot legally operate below 3888 CFM of OA, it will not be possible to save enough energy to fund the cost of improvements. The system can continue to operate as is, but major modifications will require compliance with the current code. No measure will be recommended at this time. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | Visual observation, plans, trend data, TAB test reports and staff interviews. Trends of the space temperature, space humidity and water temperatures were used to confirm the current conditions. | | |
| Measure: | The proposed measure (which would not meet code requirements for ventilation) had $24,460 for contractor cost, $3,669 provider cost, used 24,506 kWh more electric energy and saved 33,597 Th a year | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Summary

## Building: Halenbeck Hall South

## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 2 | Economizer operation. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 3 | No mixed air reset. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |

# Deleted Findings Details

## Building: Halenbeck Hall South

| | | | |
|---|---|---|---|
| FWB Number: | 11604 | Eco Number: | 2 |
| Site: | St Cloud SU | Date/Time Created: | 1/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Economizer operation. | Date Identified: | 4/4/2011 |
| Description of Finding: | AHU-7 operates at 10% OA on occupied cycle regardless the need for cooling. The OA damper operation was tested, with the assistance of the temperature control technician, and found to be inoperative. However, this is a heating only unit so no savings will come from free cooling of an economizer cycle. Therefore this Finding has been dropped from further consideration. | | |
| Equipment or System(s): | AHU with heating only | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | OA damper position trend. | | |
| Measure: | None | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: Halenbeck Hall South

| | | | |
|---|---|---|---|
| FWB Number: | 11604 | Eco Number: | 3 |
| Site: | St Cloud SU | Date/Time Created: | 1/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | No mixed air reset. | Date Identified: | 4/4/2011 |
| Description of Finding: | Mixed air temperature is fixed at 60 degrees, regardless of space temperatures, and will cause the introduction of excessive OA that will, at times require heat. (AHU-9 and 10). This measure is being dropped. Upon further review of the systems, there are a number of interior rooms being served that will require cooling during nearly all times of the year. The opportunity to save energy by increasing the mixed air setpoint will be limited at best. | | |
| Equipment or System(s): | AHU with heating only | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | N/A | | |
| Measure: | None | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Summary

## Building: Heating and Maintenance
## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 2 | Feedwater economizer. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 3 | Boiler blow down. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 6 | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 8 | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: Heating and Maintenance

| | | | |
|---|---|---|---|
| FWB Number: | 11605 | Eco Number: | 2 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Feedwater economizer. | Date Identified: | 2/17/2011 |
| Description of Finding: | Boilers #1 & 2 has no stack economizer. | | |
| Equipment or System(s): | Boiler Plant | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Mechanical & controls contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | visual inspection of boiler and boiler stack. | | |
| Measure: | Not physically possible without extensive revision to the breeching. | | |
| Recommendation for Implementation: | Based on conservation and site visit of manufacturing representative, the product manufacture has determined that the system would require major modifications to physically fit within the space available and it may impede proper operation of the boiler. | | |
| Evidence of Implementation Method: | NA | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: Heating and Maintenance

| | | | |
|---|---|---|---|
| FWB Number: | 11605 | Eco Number: | 3 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Boiler blow down. | Date Identified: | 2/17/2011 |
| Description of Finding: | No heat recovery on boiler blow down. | | |
| Equipment or System(s): | Boiler Plant | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Mechanical contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | visual inspection of boiler accessories (blow down piping) and interview with boiler operators. | | |
| Measure: | Not economically feasible. | | |
| Recommendation for Implementation: | Based on 2010 blow down data provided by US water services (SCSU water treatment company) and the energy savings calculation (as described in the DOE best practice steam tip #10) this project calculates to a simple payback of over 26 years. | | |
| Evidence of Implementation Method: | NA | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: Heating and Maintenance

| | | | |
|---|---|---|---|
| FWB Number: | 11605 | Eco Number: | 6 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | No Lighting Controls. | Date Identified: | 2/18/2011 |
| Description of Finding: | No lighting controls were found and lights were on in several areas when they were unoccupied. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of the building uncovered the fact that occupancy sensors are not being used in several logical locations. | | |
| Measure: | Installation of occupancy sensors found to be not economically feasible, please see recommendations for implementation for additional documentation. Contractor cost $4455, provider cost $668 savings 17550 kWh | | |
| Recommendation for Implementation: | Complete analysis showed energy savings below 25,000 kWh and extended paybacks (in excess of 20 years). | | |
| Evidence of Implementation Method: | Determined not economically feasible. | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: Heating and Maintenance

| | | | |
|---|---|---|---|
| FWB Number: | 11605 | Eco Number: | 8 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | No Lighting Controls. | Date Identified: | 2/18/2011 |
| Description of Finding: | No lighting controls were found in the garage work areas when they were unoccupied. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of the building uncovered the fact that occupancy sensors are not being used in several logical locations. | | |
| Measure: | Installation of occupancy sensors found to be not economically feasible, please see recommendations for implementation for additional documentation. Contractor cost $1485, provider cost $223 savings 4309 kWh | | |
| Recommendation for Implementation: | Complete analysis showed energy savings below 25,000 kWh and extended paybacks (in excess of 18 years). | | |
| Evidence of Implementation Method: | Determined not economically feasible. | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Summary

PBEEEP State Government

Building: James W. Miller LRC

Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 4 | Over ventilation. AHU-1 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 5 | Over ventilation. AHU-1 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 7 | Over ventilation. AHU-2 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 9 | Leaky Damper. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 10 | Over ventilation. AHU-3 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 12 | Over ventilation. AHU-4 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 13 | Over ventilation. AHU-5 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 14 | HX failure. AHU-9 | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |



PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 4 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over ventilation. AHU-1 | Date Identified: | 2/18/2011 |
| Description of Finding: | The AHU-1 control system was designed to modulate outside air ventilation rates based on controlling space carbon dioxide(CO2) levels and measurement of airflows. The system has been modified to use a fixed minimum OA damper position, which will often over-ventilate the space increase heating and cooling cost. OA flow and CO2 measurements indicate that there is a very limited reduction of OA flow is possible. No measure is recommended. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | A review of the original specifications confirmed the demand controlled ventilation design, screen shots and & trend data. Staff interviews indicated that the demand controlled ventilation system had been disabled and trend data with suspicious readings have confirmed this. The return air flow is about 25,000 CFM while the supply is only 10,000 and return air CO2 is always about 1998 PPM. These are inconsistencies that indicate a need for sensor replacement or recalibration. | | |
| Measure: | None | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 5 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over ventilation. AHU-1 | Date Identified: | 2/18/2011 |
| Description of Finding: | During unoccupied operation, trend data indicates that the OA damper is closed, but low mixed air temperatures indicate a significant percentage of outside air is entering the system. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | The mixed air temperature (MAT) trend data indicates that approximately 15% OA is entering the building during hours that the building is officially unoccupied and in that operating mode. | | |
| Measure: | This option is being deleted as it will be superseded by Measure 3 above. | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 7 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over ventilation. AHU-2 | Date Identified: | 2/18/2011 |
| Description of Finding: | The AHU-2 control system was designed to modulate outside air ventilation rates based on controlling space carbon dioxide(CO2) levels and measurement of airflows. The system has been modified to use a fixed minimum OA damper position, which will often over-ventilate the space increase heating and cooling cost. OA flow and CO2 measurements indicate that there is a very limited reduction of OA flow is possible. No measure is recommended. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | A review of the original specifications confirmed the demand controlled ventilation design. Staff interviews indicated that the demand controlled ventilation system had been disabled and trend data with readings inconsistent with DCV, have confirmed the change. | | |
| Measure: | None | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 9 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Leaky Damper. | Date Identified: | 5/15/2011 |
| Description of Finding: | The AHU-3 MAT often falls to temperatures well below the indoor ambient, during non-operating hours and cold weather. The OA damper should be closed, but has significant leakage. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | Trend data was used to identify this problem. VAV airflow is used in lieu of status points to verify AHU operating hours. MATs were observed to drop below freezing during non-operating hours for this system. The MAT should be approximately equal to the indoor space temperature in this mode. | | |
| Measure: | None | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 10 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over ventilation. AHU-3 | Date Identified: | 2/18/2011 |
| Description of Finding: | The AHU-3 control system was designed to modulate outside air ventilation rates based on controlling space carbon dioxide(CO2) levels and measurement of airflows. The system has been modified to use a fixed minimum OA damper position, which will often over-ventilate the space increasing heating and cooling cost. The CO2 sensors have failed or are grossly out of calibration. The OA is indicated at 1990 when it should be about 400 and the RA CO2 is listed at 57 when it should be a minimum of 375 and probably 500. The discharge air flow listed as -5000 when it is estimated to be 10,000 to 19,350 CFM. OA flow and CO2 measurements indicate that there is a very limited reduction of OA flow is possible. No measure is recommended. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | A review of the original specifications confirmed the demand controlled ventilation design. Staff interviews indicated that the demand controlled ventilation system had been disabled and trend data with readings inconsistent with DCV, have confirmed the change. | | |
| Measure: | None | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 12 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over ventilation. AHU-4 | Date Identified: | 2/18/2011 |
| Description of Finding: | The AHU-4 control system was designed to modulate outside air ventilation rates based on controlling space carbon dioxide(CO2) levels and measurement of airflows. The system has been modified to use a fixed minimum OA damper position, which will often over-ventilate the space increasing heating and cooling cost. The OA CO2 sensor has an unexpectedly high reading of 650 PPM and appears to be inaccurate. 400 PPM would be normal for OA. The air flow measuring station readings are reasonable, but the oA reading seems low at 238 CFM on a Feb 15 screen shot. OA flow and CO2 measurements indicate that there is a very limited reduction of OA flow is possible. No measure is recommended. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | A review of the original specifications confirmed the demand controlled ventilation design. Staff interviews indicated that the demand controlled ventilation system had been disabled and trend data with readings inconsistent with DCV, have confirmed the change. | | |
| Measure: | None | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |


PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 13 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over ventilation. AHU-5 | Date Identified: | 2/18/2011 |
| Description of Finding: | The AHU-5 control system was designed to modulate outside air ventilation rates based on controlling space carbon dioxide(CO2) levels and measurement of airflows. The system has been modified to use a fixed minimum OA damper position, which will often over-ventilate the space increasing heating and/or cooling cost. The OA CO2 sensor has a reading of 361 PPM on a screenshot, which is below the worldwide ambient. OA flow and CO2 measurements indicate that there is a very limited reduction of OA flow is possible. No measure is recommended. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | | Benefits: | |
| Baseline Documentation Method: | A review of the original specifications confirmed the demand controlled ventilation design. Staff interviews indicated that the demand controlled ventilation system had been disabled and trend data with readings inconsistent with DCV, have confirmed the change. | | |
| Measure: | None | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: James W. Miller LRC

| | | | |
|---|---|---|---|
| FWB Number: | 11606 | Eco Number: | 14 |
| Site: | St Cloud SU | Date/Time Created: | 2/28/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | HX failure. AHU-9 | Date Identified: | 2/18/2011 |
| Description of Finding: | AHU-9 is a 100% OA system with an energy recovery wheel. The wheel has deteriorated to the point of being inoperative, there is no need for a 100% OA operation and the system is undersized for the area currently served. Space usage has changed over time and at least one additional room has been added to the system. This system should be considered for complete replacement, rather than repair, because the space ventilation requirements are inconsistent with the 100% outside air system. Energy savings will not support a comprehensive redesign and replacement. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Mechanical, electrical and control contractor | Benefits: | Outside air ventilation rates can be substantially reduced which directly reduces the energy required to heat and cool the outside air. |
| Baseline Documentation Method: | Observed deteriorating heat wheel media and saw the heat wheel motor overload and trip off. , staff interviews & trend data. | | |
| Measure: | Replace unit with a conventional air handling unit that does not require 100% outside air. | | |
| Recommendation for Implementation: | Design and install a conventional air handling unit that does not require 100% outside air. This work is outside of the PBEEEP scope. | | |
| Evidence of Implementation Method: | This work is outside of the PBEEEP scope. | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Summary

PBEEEP State Government

Building: Mitchell Hall

Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 1 | Over ventilation AHU-1. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 4 | Limited Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |



PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: Mitchell Hall

| | | | |
|---|---|---|---|
| FWB Number: | 11607 | Eco Number: | 1 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Over ventilation AHU-1. | Date Identified: | 2/15/2011 |
| Description of Finding: | AHU-1 Outside Air (OA) damper remains open at night during unoccupied hours (midnight to 7am). Deleted 11/1/11. Summer trend data was found to have no correlation between OA damper position and OA fraction based on temperature calculation. The AHU has a nominal flow rate of 7,000 CFM, appears in some cases to maintain a 10% minimum OA fraction, but the trend data is too unreliable to support a conservation measure. | | |
| Equipment or System(s): | AHU with heating and cooling | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Controls contractor | Benefits: | Energy savings |
| Baseline Documentation Method: | N/A | | |
| Measure: | | | |
| Recommendation for Implementation: | | | |
| Evidence of Implementation Method: | | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: Mitchell Hall

| | | | |
|---|---|---|---|
| FWB Number: | 11607 | Eco Number: | 4 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | Limited Lighting Controls. | Date Identified: | 2/18/2011 |
| Description of Finding: | Limited lighting controls were found and lights were on in several areas when they were unoccupied. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of the building indicates occupancy sensors are not being used in several logical locations. | | |
| Measure: | Installation of occupancy sensors found to be not economically feasible, please see recommendations for implementation for additional documentation. Contractor cost $8168, provider cost $680, savings 1285 kWh | | |
| Recommendation for Implementation: | Complete analysis showed energy savings below 25,000 kWh and extended paybacks (in excess of 60 years) | | |
| Evidence of Implementation Method: | Determined not economically feasible. | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Summary

## Building: Husky Stadium

## Site: St Cloud SU

| Eco # | Investigation Finding | Total Cost | Savings | Payback | Co-Funding | Payback Co-Funding | GHG |
|---|---|---|---|---|---|---|---|
| 3 | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| 5 | No Lighting Controls. | $0 | $0 | 0.00 | $0 | 0.00 | 0 |
| | **Total for Findings with Payback 3 years or less:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |
| | **Total for all Findings:** | **$0** | **$0** | **0.00** | **$0** | **0.00** | **0** |



PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

# Deleted Findings Details

## Building: Husky Stadium

| | | | |
|---|---|---|---|
| FWB Number: | 11609 | Eco Number: | 3 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | No Lighting Controls. | Date Identified: | 2/18/2011 |
| Description of Finding: | No lighting controls were found and lights were on in several areas when they were unoccupied. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of the building uncovered the fact that occupancy sensors are not being used in several logical locations. | | |
| Measure: | Installation of occupancy sensors found to be not economically feasible, please see recommendations for implementation for additional documentation. Contractor cost 3$3068, provider cost $460, savings 743 kWh | | |
| Recommendation for Implementation: | Complete analysis showed energy savings below 25,000 kWh and extended paybacks (in excess of 80 years). | | |
| Evidence of Implementation Method: | Determined not economically feasible. | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

# Deleted Findings Details

## Building: Husky Stadium

| | | | |
|---|---|---|---|
| FWB Number: | 11609 | Eco Number: | 5 |
| Site: | St Cloud SU | Date/Time Created: | 5/30/2012 |

| | | | |
|---|---|---|---|
| Investigation Finding: | No Lighting Controls. | Date Identified: | 2/18/2011 |
| Description of Finding: | No lighting controls were found in corridors that were unoccupied. | | |
| Equipment or System(s): | Interior Lighting | Finding Category: | Deleted |
| Finding Type: | Finding Deleted by Provider | | |

| | | | |
|---|---|---|---|
| Implementer: | Lighting contractor | Benefits: | Energy Savings |
| Baseline Documentation Method: | Visual inspection of the building uncovered the fact that occupancy sensors are not being used in several logical locations. | | |
| Measure: | Installation of occupancy sensors found to be not economically feasible, please see recommendations for implementation for additional documentation. Contractor cost $1534, provider cost $230, savings 1264 kWh | | |
| Recommendation for Implementation: | Complete analysis showed energy savings below 25,000 kWh and extended paybacks (in excess of 20 years). | | |
| Evidence of Implementation Method: | Determined not economically feasible. | | |

| | | | |
|---|---|---|---|
| Estimated Annual Total Savings ($): | $0 | Utility Co-Funding for kWh ($): | $0 |
| Initial Simple Payback (years): | 0.00 | Utility Co-Funding for kW ($): | $0 |
| Simple Payback w/ Utility Co-Funding (years): | 0.00 | Utility Co-Funding for therms ($): | $0 |
| GHG Avoided in U.S. Tons (C02e): | 0 | Utility Co-Funding - Estimated Total ($): | $0 |

| Current Project as Percentage of Total project | | | |
|---|---|---|---|
| Percent Savings (Costs basis) | 0.0% | Percent of Implementation Costs: | 0.0% |

PBEEEP
State Government

# Public Buildings Enhanced Energy Efficiency Program

# ATTACHMENT 4: SCREENING RESULTS FOR SAINT CLOUD STATE UNIVERSITY- BUILDING GROUP 1


**October 1, 2010**

## Campus Overview

| Saint Cloud State University | |
|---|---|
| Location | 740 4th Avenue South<br>St. Cloud, MN 56301 |
| Facility Manager | John Frischmann,<br>Acting Buildings and Grounds Director |
| Number of Buildings | 56 |
| Interior Square Footage | 3,136,612 |
| PBEEEP Provider | Center for Energy and Environment (Angela Vreeland and Neal Ray) |
| Date Visited | 3/23/2010 |
| State Project Manager | John Frischmann |
| Annual Energy Cost | $3,767,766 (from 2009 utility data) |
| Utility Company | Xcel Energy (natural gas and electricity)<br>Tex-Par Oil and First Fuel Banks (fuel oil)<br>Ferrellgas (propane) |
| Site Energy Use Index (EUI) | 110 kBtu/sqft |
| Benchmark EUI (from B3) | 130 kBtu/sqft |

Saint Cloud State University (SCSU) is comprised of 56 buildings ranging in size from 600 to 235,000 interior square feet. The total area of the buildings on the campus is 3,136,612 square feet. The campus has twenty office and/or classroom buildings, twelve apartments or dormitories, an art center, a bus station, a cafeteria, two maintenance buildings, two greenhouses, a gym and recreational facility, a hockey center, a library, a heating plant, a chilled water plant, a parking ramp, a science and research building, a stadium, a student center, and a public safety building. Some of the buildings are attached to other buildings or are additions to buildings, but for the most part the buildings are detached. All of the buildings are located on campus, covering an area approximately five blocks wide by twelve blocks long. There is a map of the campus showing the location of each building within the site at the end of this report.

## Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively short (1 to 5 years) and certain payback. The screening of SCSU was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A walk-through was conducted on March 23, 2010 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and their potential for recommissioning. This report is the result of that information.

Recommendation

Due to the large size of the campus, it is recommended that the campus be divided into more than one group of buildings for the investigation phase of the PBEEEP process. The focus of this screening report is on the first group of buildings that are being recommended for investigation.

A detailed investigation of the energy usage and energy savings opportunities of the ten buildings listed below totaling 881,579 interior square feet at SCSU is recommended at this time. These buildings will be referred to as the "recommended buildings" throughout this report. The floor areas listed in the table have not been verified.

| Building Name | State ID | Building Type | Area ($ft^2$) | Year Built |
|---|---|---|---|---|
| Central Chilled Water Plant | E26073S9999 | Mechanical | 7,590 | 1999 |
| Garvey Commons | E26073S5562 | Cafeteria | 50,984 | 1962 |
| Halenbeck Hall North | E26073S1665 | Gymnasium | 132,274 | 1965 |
| Halenbeck Hall South | E26073S1660 | Gymnasium | 100,000 | 1980 |
| Heating & Maintenance I | E26073S1050 | Mechanical | 18,892 | 1950 |
| James W. Miller LRC | E26073S9600 | Library | 235,000 | 2000 |
| Mitchell Hall | E26073S5258 | Dormitory | 109,784 | 1958 |
| National Hockey Center | E26073S2889 | Hockey Rink | 152,055 | 1989 |
| Recreation Facility | E26073S10104 | Recreation Facility | 40,000 | 2005 |
| Stadium Building | E26073S10204 | Stadium | 35,000 | 2004 |

Details obtained through the screening process regarding the recommended buildings are included in the following:

***Mechanical Equipment***

The Heating Plant is located on the southern end of campus and has three steam boilers that serve the entire campus. The boilers supply 115 psi steam year-round. The steam from the Heating Plant is routed to the buildings in underground tunnels and runs through heat exchangers located in each building. The heat exchangers transfer heat from the steam to water that is pumped to the air handlers, fin tube radiation and/or reheats in each building. All of the recommended buildings use steam from the heating plant except for the Central Chilled Water Plant, which is heated by unit heaters and the National Hockey Center which has its own hot water boiler. The Central Chilled Water Plant is located adjacent to the Heating Plant and has two chillers and two cooling towers. There are two primary pumps and two secondary pumps that send water to, and circulate water throughout, the buildings. Some of the buildings located further from the Central Chilled Water Plant have chilled water pumps that distribute chilled

water throughout those buildings. All of the recommended buildings use chilled water from the Central Chilled Water Plant except for Halenbeck Hall North and South and Mitchell Hall. Halenbeck Hall North and South are not cooled except for the pool area which has direct expansion (DX) cooling with a condensing unit. Mitchell Hall also contains DX cooling with a condensing unit. The following table lists the key mechanical equipment in the buildings recommended for investigation.

| **Mechanical Equipment Summary Table** | |
|---|---|
| 1 | Tracer Summit Building Automation System by Trane |
| 10 | Buildings |
| 881,579 | Interior Square Feet |
| 62 | Air Handlers |
| 3 | Rooftop Units |
| 259 | VAV Boxes |
| 39 | Exhaust Fans and Power Roof Ventilators |
| 16 | Unit Heaters |
| 1 | Make-up Air Units |
| 2 | Chillers |
| 2 | Cooling Towers |
| 3 | Steam Boilers (dual fuel- natural gas or fuel oil) |
| 1 | Hot Water Boilers (natural gas) |
| 20 | Pumps (HW, CHW, etc) |
| 4 | Heat Exchangers |
| 750 | Approximate number of points for trending |

***Controls and Trending***

All ten buildings being recommended for investigation are controlled, to some extent, by a Tracer Summit Building Automation System (BAS) by Trane. There are five buildings among the Phase 1 group that currently have Building Control Unit (BCU) panels that are outdated and have limited memory. These buildings are: Central Chilled Water Plant, Halenbeck Hall North and South, James W. Miller LRC, and the Stadium and Recreation Facility. The panels will be upgraded for these buildings and the automation system will be capable of trending all buildings in Phase 1 before investigation begins.

The building staff does not have time to assist with exporting trend data; it is the preference of SCSU that any work on the automation system be performed by a Trane technician and this work will be paid for directly by a separate contract, which will be completed before the investigation begins. The points for each building in the automation system are listed in the building summary tables below.

***Lighting***

A lighting retrofit was conducted in 1996 throughout the campus, so the majority of indoor lighting is T8 32 watt lamps. The majority of indoor lighting is controlled by occupancy sensors and the outdoor lighting is controlled by the BAS, which operates the lighting based on schedules and photocells. Opportunities for energy savings due to lighting fixture and control improvements may exist.

***Energy Use Index B3 Benchmark***

The site Energy Use Index (EUI) of the entire campus is 110 kBtu/sqft, which is 15.4% lower than the B3 Benchmark of 130 kBtu/sqft. There is no submetering. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks. This indicates that SCSU has the

potential to further reduce its energy use. In addition, because the site is not sub-metered, the performance of individual buildings is not quantified at this time.

***Metering***

The campus has a total of twenty-eight natural gas meters, twenty-six electrical meters, three fuel oil meters, and one propane meter that are currently active. There are three main electric service entries for the campus which all serve a single campus loop; the service entries allow Xcel energy to balance loads served by three substations. The other electric meters generally serve smaller detached buildings. Similarly there are gas meters that serve kitchen and laboratory areas in addition to the main gas meter. None of the recommended buildings are individually metered.

***Documentation***

There is a significant amount of mechanical documentation, including equipment schedules, renovation prints, balance reports for a few buildings, and control sequences; however, the organization and location of those documents could make finding information difficult. Very little of the documentation is available in electronic form.

Reasons for Recommendations

There are many factors that are part of the decision to recommend an energy investigation of a building; at SCSU the following characteristics were important in the building selection process:

- Square footage
- Level of control by the building automation system
- Equipment size and quantity
- Frequency and severity of comfort and/or control issues
- Support from the staff and management to include specific buildings in an investigation

From a campus-wide standpoint, there are two main reasons for recommending that SCSU move forward with the investigation of a selection of buildings:

- The annual energy cost averages $1.24 per square foot; a reduction in this cost should support the cost of the energy investigation
- B3 data shows that while the campus is below the benchmark value, it is about 14% higher than the average of all buildings in the database.

Building Summary Tables

The following tables are based on information gathered from interviews with facility staff, building walk-throughs, automation system screen-captures, and equipment documentation. The purpose of these tables is to provide the size and quantity of equipment and the level of control present in each building. It is complete and accurate to the best of our knowledge. The buildings below are to be included in the first phase of buildings to begin the PBEEEP Investigation process.

**Central Chilled Water Plant**
State ID# E26073S9999

| Area (sqft) | 7,590 | Year Built | 1999 | Occupancy (hrs/yr) | N/A |
|---|---|---|---|---|---|

HVAC Equipment

| Description | Type | Size | Notes |
|---|---|---|---|
| 2 Chillers | Centrifugal | 204 Tons each | Trane Centravac |
| 2 Cooling Towers | | (4) 30 HP motors, 120 HP total | Both towers have VFDs |
| 4 CHW Pumps | Variable Volume with VFDs | 2 Primary 40 HP and 2,580 gpm each, 2 Secondary 125 HP and 3,600 gpm each | 2 primary loop and 2 secondary loop pumps |
| 2 CDW Pumps | Variable Volume with VFDs | 50HP, 2,630 gpm each | |
| 3 Unit Heaters | | Unknown | |

Points on BAS

| Description | Points |
|---|---|
| Cooling System | Chiller mode (unoccupied/occupied), Restart inhibit timer, CHW entering, CHW leaving, CHW flow, Evaporator approach, CDW entering, CDW leaving, CDW flow, Inlet vane position, Compressor Rated Load Amps (RLA), Oil pressure, OA Enth, Chiller Start Enth, CHW pump status, CHWDP, CHWST, CHWRT, Tower status, Tower speed, Tower isolation valves |

Additional Comments

- This is the central chilled water plant that distributes chilled water to the entire campus.
- The unit heaters are the only source of heating for the entire building.

| **Garvey Commons**<br>State ID# E26073S5562 | | | | | |
|---|---|---|---|---|---|
| Area (sqft) | 50,984 | Year Built | 1962 | Occupancy (hrs/yr) | 5,500 |

HVAC Equipment

| **Description** | **Type** | **Size** | **Notes** |
|---|---|---|---|
| AHU-1 | VAV unit with SF and RF with VFDs | 16,700 CFM,<br>15 HP SF,<br>3 HP RF | Serves 5 VAV boxes |
| AHU-2 | VAV unit with SF and RF with VFDs | 15,400 CFM,<br>15 HP SF,<br>3 HP RF | Serves 4 VAV boxes |
| AHU-3 | VAV MAU for kitchen, SF and EF with VFDs | 15 HP SF,<br>10 HP EF | Interlocked with exhaust fan for kitchen |
| Bakery AHU | Constant Volume | 5 HP SF | |
| AHU-5 | VAV SF with VFD | 5 HP SF | VFD controlled off space temperature |
| 10 EFs | Constant Volume | EF-10 rated at 3 HP,<br>EF-11 rated at 11 HP.<br>All other under 1 HP | |
| 1 CHWP | Constant Volume | 10 HP | |
| 9 VAV boxes | | | HW reheat coils |

Points on BAS

| **Description** | **Points** |
|---|---|
| AHU-1<br>AHU-2 | Econ damper, RA damper, Relief damper, Econ damper minimum setpoint, MAT, MAT setpoint, MAT low limit, DAT, DAT setpoint, Duct static, Duct static setpoint, Space static, Space static setpoint, SF status, SF command, SF speed, Cool valve %, Heat valve %, Face bypass damper %, RAT, RA CO2, VAV average temperature, VAV average temperature setpoint, RAT, RF status, RF command, RF speed |
| AHU-3 | OA damper, DAT, DAT setpoint, Space pressure, Space pressure setpoint, SF status, SF command, SF speed, Cool valve, Heat valve, Face bypass damper %, Kitchen EF status |
| EF | EF status, EF command |
| CHWP | Pump status, Pump command |
| VAV | Space temp, VAV DAT, VAV flow, Heat on/off |

Additional Comments

- This 2-story building houses four dining rooms, a kitchen, and a bakery.
- Chilled water comes from central chilled water plant.
- Steam comes from heating plant.
- Interior lighting stated to be controlled by 10% occupancy sensors and 90% manual switches.

| Halenbeck Hall North<br>State ID# E26073S1665 | | | | | |
|---|---|---|---|---|---|
| Area (sqft) | 132,274 | Year Built | 1965 | Occupancy (hrs/yr) | 5,000 |

HVAC Equipment

| Description | Type | Size | Notes |
|---|---|---|---|
| AHU 12,<br>AHU 13,<br>AHU 14,<br>AHU 15,<br>AHU 16,<br>AHU 17,<br>AHU 18,<br>AHU 19,<br>AHU 20,<br>AHU 21 | Constant volume | 1.5 HP each | HW, no cooling, only run 2 AHUs at a time, serve the Main Gym |
| Dance Studio AHU,<br>Handball Courts AHU,<br>Men's Locker Rm AHU,<br>Women's Locker Rm AHU,<br>Office AHU,<br>Perim. Office AHU,<br>Sports Info Office AHU,<br>Weight Rm AHU | Constant Volume | 3 HP or less each | HW, no cooling |
| 1 Steam to Hot Water HX | | | Provides hot water to North and South Halenbeck |
| 2 HWPs | Constant Volume | (1) 7.5 HP,<br>(1) 5 HP | |
| 4 EFs | Constant Volume | 2 HP each | Serve the Main Gym, staged based on space temp |

Points on BAS

| Description | Points |
|---|---|
| AHUs 12 through 21 | SF status, Space temp, DAT, HW valve, MAT, Damper position |
| Dance Studio through Weight Rm AHUs | SF status, Space temp, Space setpoint |
| Heating System | Steam valve, HWST, Radiation pump status |
| EF | EF status, Space setpoint |

Additional Comments- Halenbeck Hall North

- Along with Halenbeck Hall South, these buildings house a main gym, a swimming pool, diving pool, two small gyms, a track, racquetball courts, wrestling room, weight room, and dance studio.
- This building is not cooled.
- Steam comes from central plant.
- The Main Gym gets overheated during the summer because there is no cooling.
- There are a lot of weekend events in this building including graduation ceremonies.
- Interior lighting stated to be controlled by 60% occupancy sensors, 10% schedule, and 30% manual switches.

**Halenbeck Hall South**
State ID# E26073S1660

| Area (sqft) | 100,000 | Year Built | 1980 | Occupancy (hrs/yr) | 5,000 |
|---|---|---|---|---|---|

HVAC Equipment

| Description | Type | Size | Notes |
|---|---|---|---|
| SF1, SF2, SF3, SF4, SF5, SF6, SF7, SF8, SF9 | Constant Volume AHUs | 10 HP each | Steam, no cooling |
| SF10 | Constant Volume AHU | 7.5 HP | Steam, no cooling |
| Pool AHU | Constant Volume | 13,800 cfm, 15 HP | HW, DX cooling |

Points on BAS

| Description | Points |
|---|---|
| SF1-SF6, SF8 | Fan status |
| SF7,SF9-10 | Fan status, MAT, Damper position, Hot Deck Temp, Valve Position |
| Pool AHU | RAT, RARH, SF status, DX on/off, HW valve |
| Pool Controls | DX heat reclaim on/off, Pump status, Pool temp, Steam valve |

Additional Comments

- See Halenbeck Hall North for the space uses in this building.
- This building is not cooled, except for the pool area, which has DX cooling.
- Steam comes from central plant.
- Hot water comes from Halenbeck Hall North.
- Interior lighting stated to be controlled by 20% occupancy sensors and 80% manual switches.

| Heating and Maintenance I<br>State ID# E26073S1050 | | | | | |
|---|---|---|---|---|---|
| Area (sqft) | 18,892 | Year Built | 1950 | Occupancy (hrs/yr) | 2,470 |

HVAC Equipment

| Description | Type | Size | Notes |
|---|---|---|---|
| 3 Boilers | Steam | (2) 70,000 kBtu/hr, (1) 40,000 kBtu/hr | The steam pressure is kept at 115 psi year-round. Boilers can use natural gas, fuel oil #2, or fuel oil #6. |
| MAU | Constant Volume | Unknown | Direct gas-fired, not steam. |

Points on BAS

| Description | Points |
|---|---|
| Boiler 1 | *No points available* |
| Boiler 2 | *No points available* |
| Boiler 3 | Firing rate, Oxygen, Flue temp, O2 trim, Drum level, Steam flow, Air flow trim, Feedwater valve, Feedwater valve setpoint, Boiler output temp/press, Combustion, Oil flow, Gas flow, Atomizing pressure |

Additional Comments

- This is the central heating plant that distributes steam to the entire campus.
- This building is not cooled.
- There are few points on the BAS for the entire heating system. There are only the points available (listed above) for Boiler 3 and no points for Boilers 1 and 2.

| James W. Miller Learning Resources Center (LRC)<br>State ID# E26073S9600 | | | | | |
|---|---|---|---|---|---|
| Area (sqft) | 235,000 | Year Built | 2000 | Occupancy (hrs/yr) | 5,000 |
| HVAC Equipment | | | | | |

| Description | Type | Size | Notes |
|---|---|---|---|
| AHU-1 | VAV unit with SF and RF with VFDs | 60 HP SF, 20 HP RF | Serves 35 VAV boxes |
| AHU-2 | VAV unit with SF and RF with VFDs | 40 HP SF, 20 HP RF | Serves 46 VAV boxes |
| AHU-3 | VAV unit with SF and RF with VFDs | 30 HP SF, 7.5 HP RF | Serves 47 VAV boxes |
| AHU-4 | VAV unit with SF and RF with VFDs | 15 HP SF, 10 HP RF | Serves 22 VAV boxes |
| AHU-5 | VAV unit with SF and RF with VFDs | 5 HP SF, 4 HP RF | Serves 36 VAV boxes |
| AHU-6 | VAV unit with SF and RF with VFDs | 5 HP SF, 3 HP RF | SF VFD controlled of zone temperature requirements |
| AHU-7, AHU-8 | Liebert Units | Unknown | These are Computer Room Air Conditioning (CRAC) units that serve the computer room and archives area |
| AHU-9 | VAV unit with SF and EF with VFDs | 7.5 HP SF, 3 HP EF | 100% OA unit utilizes an energy recovery wheel to preheat outside air. There is a glycol heat exchanger and the heating coil in this unit has glycol since this is a 100% OA unit. Contains 10 VAV boxes with hot water reheat. |
| 196 VAV boxes | | | HW reheat coils |
| 1 Steam to Hot Water HX | | | |
| 2 HWPs | Variable Volume with VFDs | 5 HP each | |
| 2 CHWPs | Variable Volume with VFDs | 7.5 HP each | |
| 13 EFs | Constant Volume | All less than 1 HP each | |
| HW FTR | | | |

Points on BAS- James W. Miller LRC

| Description | Points |
|---|---|
| AHU-1 through AHU-6 | RA dew point, RAT, RF status, RF speed, RA/OA/EA damper position, MAT, SF status, SF speed, Supply duct static, Supply duct static setpoint, Steam valve %, CHW valve %, DARH, DAT, DAT setpoint, RF offset, Humidifier valve % |
| AHU-7 | DAT, Fan status, Supply glycol temp, Return glycol temp |
| AHU-8 | Intake temp, Intake dew point, Fan status |
| AHU-9 | RAT, EF speed, EF VFD status, EAT, OA damper position, Preheat temp, Preheat valve %, SF status, SF speed, HW valve %, CHW valve %, DAT, Supply duct static, Supply duct static setpoint, Energy wheel status, Energy wheel speed, Exchanger supply temp, Exchanger return temp, Exchanger valve |
| VAV | Space temp, VAV DAT, VAV flow, Heat on/off |
| Heating System | HWDP, HW pump speed, HW pump status, Converter status, HWST, HWRT, Converter valve, Steam system pressure |
| Chilled Water | CHWST, CHWRT, CHW pump speed, CHW pump status, CHW flow, CHW differential pressure |
| EF | EF status |
| FTR | Space temp |

Additional Comments

- This 2-story building houses library space, computer rooms, auditorium, classrooms, study rooms, and a coffee shop.
- Chilled water comes from central plant.
- Steam comes from central plant.
- This building has HW fin tube radiation that is controlled to thermostats.
- Stated 98% of interior lighting is controlled by occupancy sensors.
- Building was built in 2000 and not known to be commissioned.

| **Mitchell Hall**<br>State ID# E26073S5258 | | | | | |
|---|---|---|---|---|---|
| Area (sqft) | 109,784 | Year Built | 1958 | Occupancy (hrs/yr) | 8,760 |

HVAC Equipment

| **Name** | **Type** | **Size** | **Notes** |
|---|---|---|---|
| AHU-1 | Constant volume with SF and RF | 0.75 HP SF<br>Unknown RF HP | HW and 2-stage DX, serves corridors, computer room, and activity room main lobby. |
| 2 EFs | | Less than 1 HP each | |
| 1 DX Unit | | 20 Tons | Serves AHU-1 |
| 2 Radiation HW Pumps | Constant volume | 5 HP each | HW pumps for radiation in dorm rooms. |

Points on BAS

| **Name** | **Points** |
|---|---|
| AHU-1 | Roof isolation damper, Econ/return damper, Relief damper, Minimum relief damper setpoint, MAT, MAT setpoint, SF status, SF command, Heat valve, Cooling stage 1, Cooling stage 2, DAT, DAT setpoint, RAT, Heating space temperature setpoint, Cooling space temperature setpoint, 3rd floor lounge temperature, 2nd floor lounge temperature, Average space temperature, RAT, RF status, RF command, OAT |
| Heating System | HWST, HWST setpoint, Pump status, Pump command |
| EF | EF status, EF command |

Additional Comments

- This is a 4-story dormitory that houses 418 women.
- AHU-1 utilizes a 20 ton condensing unit for cooling.
- Steam comes from central plant.
- Interior lighting stated to be controlled by manual switches.

| National Hockey Center<br>State ID# E26073S2889 | | | | | |
|---|---|---|---|---|---|
| Area (sqft) | 152,055 | Year Built | 1989 | Occupancy (hrs/yr) | Varies |

HVAC Equipment

| Name | Type | Size | Notes |
|---|---|---|---|
| Main Rink Desiccant Unit | Constant Volume | 40 HP SF,<br>10 HP RF | |
| Practice Rink Desiccant Unit | Constant Volume | 20 HP SF,<br>5 HP RF | |
| AHU-1 | Constant Volume | 2.5 HP SF | |
| AHU-2 | Constant Volume | 2.5 HP SF | |
| AHU-6 | Constant Volume | 3 HP SF | |
| AHU-7 | Constant Volume | 3 HP SF | |
| SE RTU | Constant Volume | 40 HP SF,<br>15 HP RF | |
| SW RTU | Constant Volume | 40 HP SF,<br>15 HP RF | |
| NW RTU | Constant Volume | 40 HP SF,<br>15 HP RF | |
| 10 Exhaust Fans | | All less than 1 HP | |
| Boiler | | 900 kBtu/hr | HW boiler for perimeter radiation |

Points on BAS

| Name | Points |
|---|---|
| Desiccant Units | SF status, DAT, DA humidity, RTU status, Space humidity, Space temperature |
| AHUs | Control point (on/off), Status |
| RTUs | Fan command, DAT, Damper position, Space static pressure, Space static pressure setpoint |
| Exhaust Fans | EF command, EF status |
| Reheats | Fan status, Room stat, Space temperature, Space temperature setpoint, Reheat valve |

Additional Comments

- This 3-story building houses two Olympic size hockey rinks, locker rooms, offices, weight rooms, and a pro shop.
- Interior lighting stated to be controlled by 30% occupancy sensors and 70% manual switches.
- This building has HW fin tube radiation.
- The lighting is currently being looked at for updating options.
- Both hockey rinks operate year-round and the ice is off each rink for a few weeks per year.
- A large addition has been designed but no date has been established for construction.

| Recreational Facility<br>State ID# E26073S10104 | | | | | |
|---|---|---|---|---|---|
| Area (sqft) | 40,000 | Year Built | 2005 | Occupancy (hrs/yr) | 5,000 |

HVAC Equipment

| Name | Type | Size | Notes |
|---|---|---|---|
| AHU-1 | VAV unit with SF and 2 RFs with VFDs | 40,000 cfm,<br>75 HP SF,<br>(2) 30 HP RFs | HW and CHW, serves 36 VAV boxes in Recreational Facility and Stadium |
| AHU-2 | VAV unit with SF and RF with VFDs | 10,000 cfm,<br>9.5 HP SF,<br>7.5 HP RF | 100% OA, glycol heating coil and CHW, Heat recovery wheel between EA and OA, serves 18 VAV boxes in Stadium locker rooms. |
| 54 VAV boxes | | | All of the VAV boxes have HW reheat, except a few have electric resistance. |
| 13 Unit Heaters | | | Steam heat |
| 1 Steam to HW HX | | | |
| 1 HW to Glycol HX | | | AHU-2 is 100% OA, so the heating coil is glycol to prevent freezing of coil. |
| 2 HW Pumps | Variable Volume with VFDs | 15 HP each | |
| 2 Glycol Pumps | Constant Volume | 1.7 HP each | |
| 2 CHW Pumps | 1 Constant Volume, 1 Variable Volume with VFD | 20 HP each | |

Points on BAS

| Name | Points |
|---|---|
| AHU-1 | RAT, RARH, RA DSP, RF status, RF speed, OA/RA/EA damper position, MAT, SF status, SF speed, HW Valve, CHW valve, DAT, DA DSP, Space static pressure |
| AHU-2 | RAT, RARH, Heat wheel status, Heat wheel speed, EAT, EARH, EA damper position, EF status, EF speed, Temp after heat wheel and before coils, Glycol heating valve, CHW valve, SF status, SF speed, DA DSP, DAT |
| VAV Boxes | Zone temp, VAV DAT, VAV flow, Heat on/off |
| Heating System | Steam valve, HWST, HW pump status, HWDP, HW pump speed, Glycol pump status, HW valve position, Glycol temp |
| Cooling System | CHWDP, CHW pump status, CHW pump speed, Secondary CHWST, Secondary CHWRT, Primary CHWRT, CHW return valve |
| Unit Heaters | Space temp, Unit status, Heat % |

| Additional Comments- Recreational Facility |
|---|
| • This building houses workout facilities for the students and a café.<br>• Chilled water comes from central plant.<br>• Steam comes from central plant.<br>• Interior lighting stated to be controlled by 95% occupancy sensors and 5% manual switches.<br>• The Stadium shares equipment with this building. |

| **Stadium**<br>State ID# E26073S10204 | | | | | |
|---|---|---|---|---|---|
| Area (sqft) | 35,000 | Year Built | 2004 | Occupancy (hrs/yr) | Variable |
| HVAC Equipment | | | | | |
| • NOTE: This building shares HVAC equipment with the Recreational Facility. | | | | | |
| Points on BAS | | | | | |
| • See the Recreational Facility. | | | | | |
| Additional Comments | | | | | |
| • This building houses locker rooms, restrooms, concessions, and indoor seating for sporting events.<br>• There is a dome that covers the field during the winter. The dome shall NOT be included in the investigation of this building. | | | | | |

Buildings Outside of the Scope of the Current Screening Report

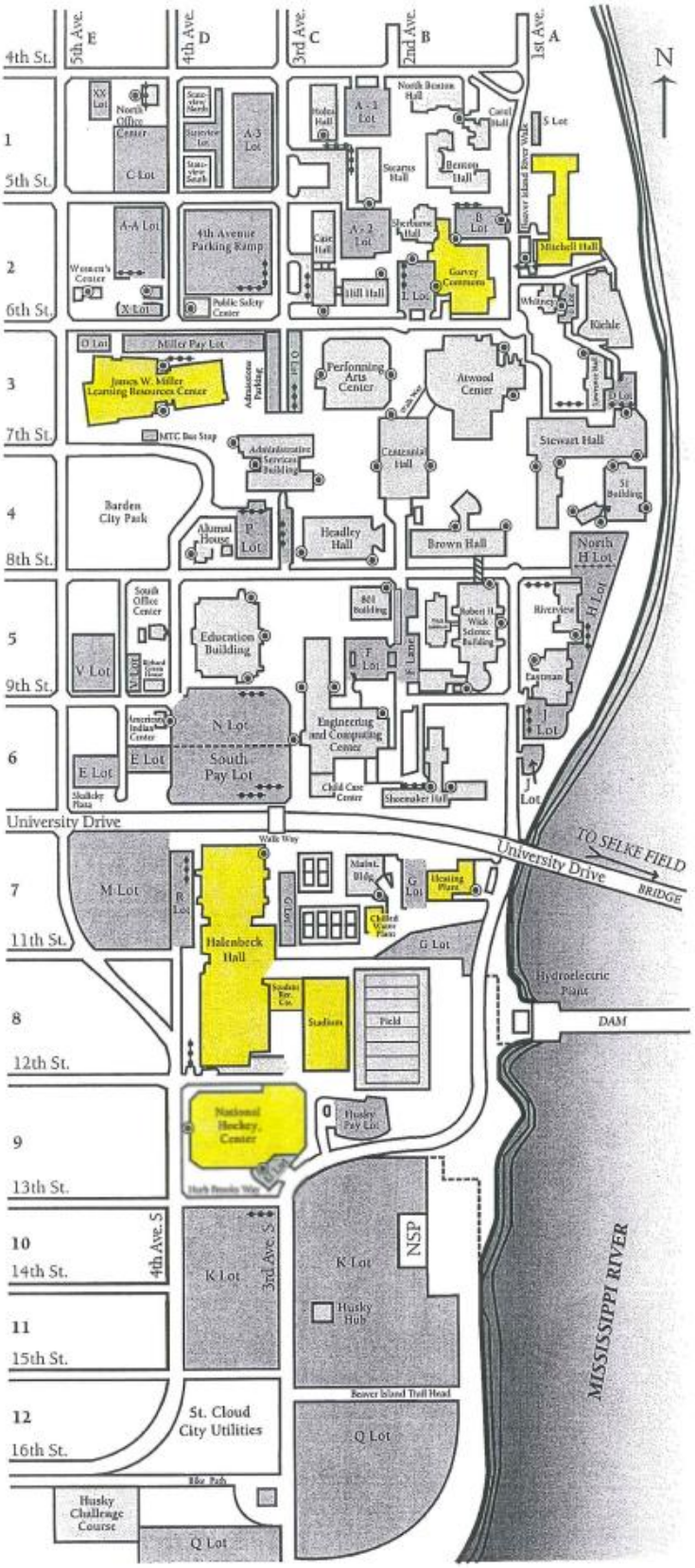
These are the remaining buildings on campus that are not part of the Phase 1 group of buildings. They may or may not be recommended for future phases of investigation.

| Building Name | State ID | Building Type | Area ($ft^2$) | Year Built |
|---|---|---|---|---|
| 51 Building | E26073S1868 | Academic | 52,085 | 1968 |
| 51 Building Wing | | Academic | 6,150 | 1993 |
| 525 Building | | Unknown | 3,008 | 1989 |
| 801 Building | E26073S2788 | Temp. Office | 12,100 | 1988 |
| Administration Service Bldg | E26073S2475 | Academic | 59,545 | 1975 |
| Alumni House | E26073S0525 | Academic | 6,108 | 1925 |
| American Indian Center | E26073S0425 | Academic | 2,563 | 1925 |
| Atwood Memorial Center | E26073S8066 | Student Center | 181,465 | 1966 |
| Benton Hall North | | Dormitory | 25,617 | 1968 |
| Benton Hall South | E26073S6067 | Dormitory | 35,375 | 1967 |
| Brown Hall | E26073S1358 | Academic | 78,821 | 1958 |
| Carol Hall | E26073S5126 | Academic | 13,512 | 1926 |
| Case Hall | E26073S5663 | Dormitory | 40,492 | 1964 |
| Case/Hill Lounge | | Lounge | | |
| Hill Hall | E26073S5461 | Dorm/Health Center | 42,342 | 1962 |
| Centennial Hall | E26073S2071 | Academic | 165,758 | 1971 |
| Eastman Hall | E26073S0729 | Academic | 45,997 | 1929 |
| Education Bldg | E26073S1971 | Academic | 101,006 | 1971 |
| Engineering/Computing Center | E26073S1258 | Academic | 91,840 | 1958 |
| Green House 1 | | Greenhouse | 2,258 | 1992 |
| Green House 2 | | Greenhouse | 600 | 2004 |
| Headley Hall | E26073S1462 | Academic | 52,898 | 1962 |
| Holes Hall | E26073S5764 | Dormitory | 80,213 | 1965 |
| Husky Hub | E26073S10700 | Bus Station | 1,198 | 2000 |
| Kiehle Visual Arts Center | E26073S1152 | Art Center | 59,984 | 1952 |
| Lawrence Hall | E26073S10303 | Dormitory | 13,236 | 2003 |
| Lawrence Hall (Dorm/Offic) | E26073S10303 | Dorm/Academic | 29,489 | 1905 |
| Maintenance Bldg | E26073S2680 | Maintenance | 15,392 | 1980 |
| North Office Center | E26073S0325 | Building Grounds | 4,002 | 1925 |
| Parking Ramp | E26073S5709 | Parking Ramp | 158,798 | 2008 |
| Performing Arts Center | E26073S1768 | Art Center | 78,674 | 1968 |
| Public Safety Center | E26073S5709 | Campus Security | 4,879 | 2008 |
| Richard Green House | | Academic | 3,764 | 1935 |
| Riverview Hall | E26073S0211 | Academic | 28,128 | 1911 |
| Sherburne Hall | E26073S5967 | Dormitory | 107,428 | 1969 |
| Shoemaker Hall (old) | E26073S5015 | Dormitory | 10,184 | 1915 |
| Shoemaker Hall (east and west) | E26073S5360 | Dormitory | 115,329 | 1960 |

NOTE: List continues on next page.

| Building Name | State ID | Building Type | Area ($ft^2$) | Year Built |
|---|---|---|---|---|
| South Office Center | E26073S10495 | Academic | 2,727 | 1925 |
| Stateview North | E26073S9702 | Apartments | 15,358 | 1992 |
| Stateview South | E26073S9802 | Apartments | 15,358 | 2002 |
| Stearns Hall | E26073S5866 | Dormitory | 81,180 | 1966 |
| Stewart Hall | E26073S0948 | Academic | 177,951 | 1948 |
| Whitney House | E26073S0625 | Academic | 11,383 | 1925 |
| Wick Annex | E26073S2172 | Laboratory | 38,562 | 2008 |
| Wick Science Building | E26073S2172 | Laboratory | 177,951 | 1948 |
| Women's Center | E26073S2990 | Academic | 4,325 | 1925 |

Campus Map




# ST. CLOUD STATE UNIVERSITY
# CAMPUS MAP

Visit www.StCloudState.edu/campusmap/

## TO REACH THE CAMPUS

- **From Interstate 94:** Use Exit 171, take County Road 75 into city.
- **From U.S. Highway 10:** Exit west to East St. Germain Street. Continue west until you cross the Mississippi River on Veterans Bridge. Turn south on Fourth Avenue South.
- **From the Southwest (Highway 15, 23; County Road 75):** All routes link with Division Street; turn right at Fifth Avenue South.
- **From the east (Minnesota Highway 23):** Take the U.S. Highway 10 exit north. Turn west on East St. Germain Street. Continue west until you cross the Mississippi River on Veterans Bridge. Turn south on Fourth Avenue South.

## LEGEND

| | | |
|---|---|---|
| AS | Administrative Services | C4 |
| AH | Alumni House | D4 |
| AIC | American Indian Center | E6 |
| AMC | Atwood Memorial Center | B3 |
| BTH | Benton Hall | B1 |
| BH | Brown Hall | B4 |
| BG | Buildings and Grounds | E1 |
| CRH | Carol Hall | B1 |
| CSH | Case Hall | C2 |
| CH | Centennial Hall | B4 |
| ECC | Engineering & Computing Center | C6 |
| EH | Eastman Hall | A5 |
| EB | Education Building | D5 |
| FLD | Field | B8 |
| GC | Garvey Commons | B2 |
| HaH | Halenbeck Hall | D7 |
| HH | Headley Hall | C4 |
| HiHH | Health Center | C2 |
| HP | Heating Plant | B7 |
| HiH | Hill Hall | C2 |
| HoH | Holes Hall | C1 |
| Hub | Husky Hub | C10 |
| HS | Husky Stadium | C8 |
| MC | James W. Miller Learning Resources Center (library) | D3 |
| KVAC | Kiehle Visual Arts Center | A2 |
| LH | Lawrence Hall | A3 |
| MB | Maintenance Building | C7 |
| MH | Mitchell Hall | A2 |
| NHC | National Hockey Center | D9 |
| NOC | North Office Center | E1 |
| NSP | NSP Building | B10 |
| PA | Performing Arts Center | C3 |
| PR | Parking Ramp | D2 |
| PSC | Public Safety Center | D2 |
| RGH | Richard Green House | E5 |
| | Riitsche Auditorium (Stewart Hall) | A4 |
| R | Riverview | A5 |
| SBH | Sherburne Hall | B2 |
| SMH | Shoemaker Hall | B6 |
| SOC | South Office Center | E5 |
| SVN | Stateview North | D1 |
| SVS | Stateview South | D1 |
| STH | Stearns Hall | C1 |
| SH | Stewart Hall (Riitsche Auditorium) | A4 |
| SRC | Student Recreation Center | C8 |
| WH | Whitney House | A2 |
| WC | Women's Center | E2 |
| WSB | Robert H. Wick Science Building (Planetarium) | B5 |
| 801B | 801 Building | C5 |
| 51B | 51 Building | A4 |

Handicapped Parking
Wheelchair Accessible Entrance

NOTE: Phase 1 buildings are highlighted in yellow.

| PBEEEP Abbreviation Descriptions | | | |
|---|---|---|---|
| AHU | Air Handling Unit | HP | Horsepower |
| BAS | Building Automation System | HRU | Heat Recovery Unit |
| CD | Cold Deck | HW | Hot Water |
| CDW | Condenser Water | HWDP | Hot Water Differential Pressure |
| CDWRT | Condenser Water Return Temperature | HWP | Hot Water Pump |
| CDWST | Condenser Water Supply Temperature | HWRT | Hot Water Return Temperature |
| CFM | Cubic Feet per Minute | HWST | Hot Water Supply Temperature |
| CHW | Chilled Water | HX | Heat Exchanger |
| CHWRT | Chilled Water Return Temperature | kW | Kilowatt |
| CHWDP | Chilled Water Differential Pressure | kWh | Kilowatt-hour |
| CHWP | Chilled Water Pump | MA | Mixed Air |
| CHWST | Chilled Water Supply Temperature | MA Enth | Mixed Air Enthalpy |
| CRAC | Computer Room Air Conditioner | MARH | Mixed Air Relative Humidity |
| CV | Constant Volume | MAT | Mixed Air Temperature |
| DA | Discharge Air | MAU | Make-up Air Unit |
| DA Enth | Discharge Air Enthalpy | OA | Outside Air |
| DARH | Discharge Air Relative Humidity | OA Enth | Outside Air Enthalpy |
| DAT | Discharge Air Temperature | OARH | Outside Air Relative Humidity |
| DDC | Direct Digital Control | OAT | Outside Air Temperature |
| DP | Differential Pressure | Occ | Occupied |
| DSP | Duct Static Pressure | PTAC | Packaged Terminal Air Conditioner |
| DX | Direct Expansion | RA | Return Air |
| EA | Exhaust Air | RA Enth | Return Air Enthalpy |
| EAT | Exhaust Air Temperature | RARH | Return Air Relative Humidity |
| Econ | Economizer | RAT | Return Air Temperature |
| EF | Exhaust Fan | RF | Return Fan |
| Enth | Enthalpy | RH | Relative Humidity |
| ERU | Energy Recovery Unit | RTU | Rooftop Unit |
| FCU | Fan Coil Unit | SF | Supply Fan |
| FPVAV | Fan Powered VAV | Unocc | Unoccupied |
| FTR | Fin Tube Radiation | VAV | Variable Air Volume |
| GPM | Gallons per Minute | VFD | Variable Frequency Drive |
| HD | Hot Deck | VIGV | Variable Inlet Guide Vanes |

| Conversions |
|---|
| 1 kWh = 3.412 kBtu |
| 1 Therm = 100 kBtu |
| 1 kBtu/hr = 1 MBH |